MARCH 9, 1959

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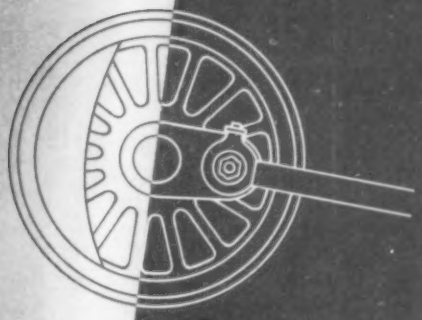
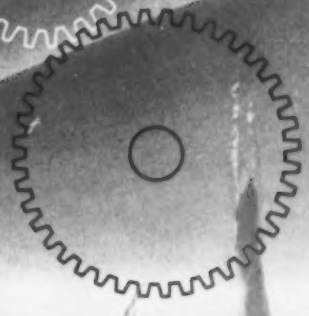
Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

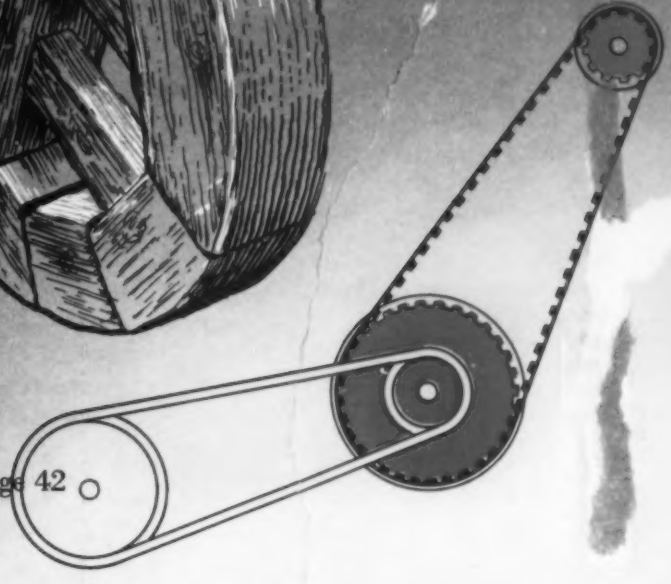
R ESEARCH
and news issue
D EVELOPMENT





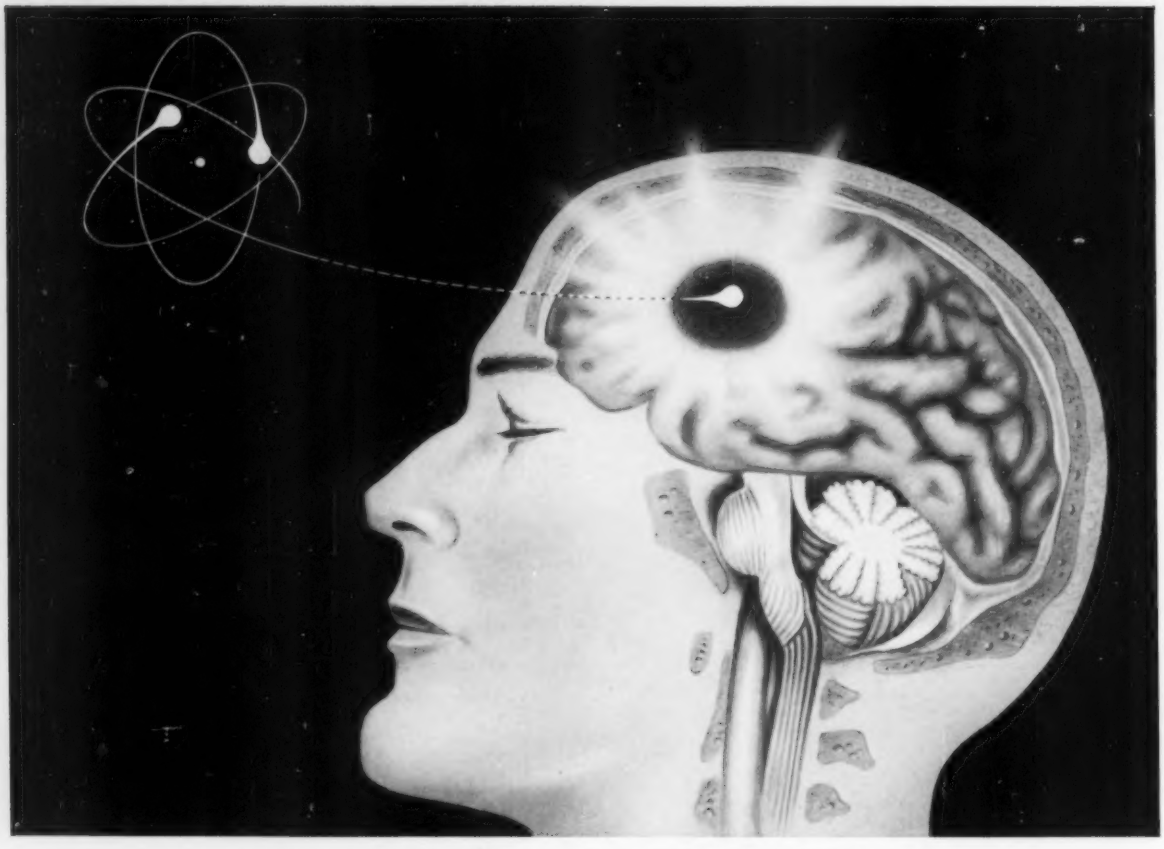
Incentives for

INVENTION



for the patentee... see page 37

for the patent user... see page 42



Neutron-sensitive isotope made in Monel fractionator

Boron-10 vs. brain tumors

Physicians and scientists working in cancer research at Brookhaven National Laboratory, Upton, N. Y., are probing the use of Boron-10 isotope in treating a common type of brain tumor *(glioblastoma multiforme)*.

Results of this therapy are so encouraging that Brookhaven and at least two other institutions are constructing additional nuclear reactors used in this therapeutic venture.

The method. In a technique known as Neutron Capture Therapy, the patient receives an injection of a Boron-10 compound. Cancerous tissue absorbs Boron-10 more rapidly than healthy tissue. While the isotope is concentrated in the tumor, neutrons from a nuclear reactor are beamed at it. The Boron-10 in the cancer absorbs most of the neutrons.

In the split second that the Boron-10 becomes radioactive, it produces short-ranged alpha particles which destroy cancerous tissue with a minimum of damage to healthy tissue.

Producing the isotope. The plant furnishing Boron-10 to Brookhaven ordinarily turns out about three pounds during a 24-hour work day. Separation of the isotope takes place in what is described as "the world's most efficient fractionating system." In 350 feet of total height, six series-connected Monel* nickel-copper alloy columns enrich a complex containing 18.8% Boron-10 isotope to one containing 92% Boron-10.

Corrosive action foiled. Throughout subsequent manufacturing processes, where equipment is constantly subject to fluoride attack, only pure Nickel or Monel alloy is used. These metals hold corrosion at arm's length in columns, reboilers, condensers, vessels, pumps, and piping.

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in this issue

Inventors are offered, for the first time, a meeting ground with a potential manufacturer.

How to pre-plan new products with a set of searching questions and a put-up-or-shut-up formula.

Some unpleasant truths about American engineering colleges and the assistance they need from industry.

What built-in obsolescence means to four high company executives and their product lines.

Eight industrial designs from the boards of American and European companies are reviewed.

Developments to Watch, principles and products now under study in the R & D laboratories of the world.

New components, materials, processes on the market, with price and availability for your design schedules.

Plus late news of the engineering world, new literature announcements and specialist-written columns specifically designed for you.

coming next week . . .

the DESIGN issue

for March 16

FEATURING

- **Meet the "insect wing" metal panel**
  Latest technique in construction of twin-sheet panels shows how spot-welded dimples give rigidity and light weight.

- **Design your own printed-circuit motor**
  How to draw up specifications for light weight, inexpensive dc motors with printed-circuit rotors.

- **Better linear polyethylene moldings**
  This growing family of plastics is overcoming its difficult-to-mold reputation.

- **Numerical integration simplifies complex design**
  An accurate tabular method for evaluating integrals, with six examples.

- **Partially loaded continuous beams**
  Formulas and curves simplify analysis.

- **11 Ways to couple tubes**
  An assortment of mechanical joints, including clamps, screws, threaded and welded sleeves.

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R D

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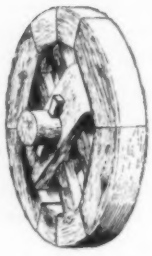

● **You can make or break the scientific mind** by the age of six, according to Dr. Margaret Mead, the world-famous anthropologist and cultural historian. Overprotected "mother's babies" never join the ranks of creative (and now greatly encouraged–p 37) inventors. A scientist or engineer must be able–no must *delight*–to live with uncertainty, danger and unbalance. Children are naturally courageous–it's our parent that "doth make cowards of us all."

● **The first American spaceman** will probably be chosen for immortality this month. Volunteers are now undergoing intensive physical and psychological tests to see if they qualify among the "dozen best." Preliminary requirements include: science or engineering degree, graduation from a military test-pilot training school, 1500 hr flight time, under 40 years, under 5 ft 11 in. tall, extraordinary emotional stability (to guard against the "only human in the universe" feeling). The Soviets may add a "proper ideology" requirement but their education standards are surely just as high (45). Willy Ley suggests a woman would be better suited than a man. She's smaller and would probably be perfectly content to gossip continuously on a ground-to-satellite radio for the anticipated 16-hr flight.

● **Noise levels are rising,** and for some reason designers treat the symptoms far more often than the disease. A while ago we received a news report from London stating that BOAC has issued ear muffs and plugs to the London airport staff as a protection against jet noise. Then we remembered last night's high-fidelity radio concert competing with the neighbor's TV. Suddenly the office typewriters and clanging phones (p 68) lifted themselves out of the background level. We opened the window and winced at the usually unheard city blare. Manhattan island must have been heaven in 1626 when progress wasn't measured in smoke-filled air, polluted rivers and deafening noise, but in sale to the Dutch.

MARCH 9, 1959 **PRODUCT ENGINEERING** Vol. 30, No. 10
A McGRAW-HILL PUBLICATION

PRODUCT ENGINEERING is published weekly—with an additional Design Digest Issue in Mid-September, by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. PUBLICATION OFFICE, 99-129 North Broadway, Albany 1, N. Y. See panel below for directions regarding subscription or change in address.

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PRODUCT ENGINEERING articles are indexed in both the **Applied Science and Technology Index** and the **Engineering Index.** PRODUCT ENGINEERING publishes its own semiannual index. Copies are obtainable on request to the Editor.

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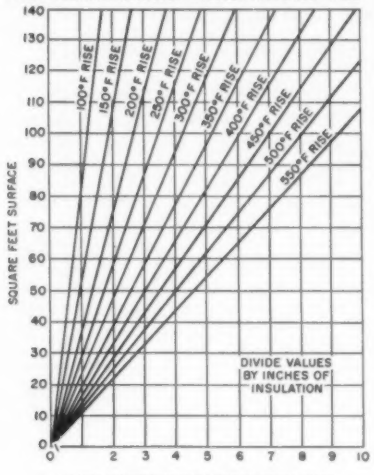
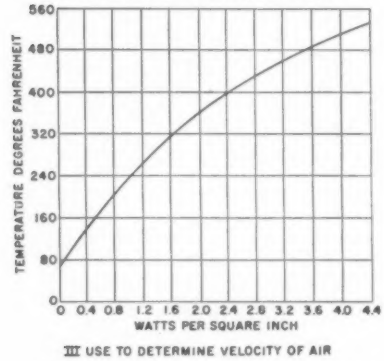
How to choose the right amount of heat for ovens and process air applications

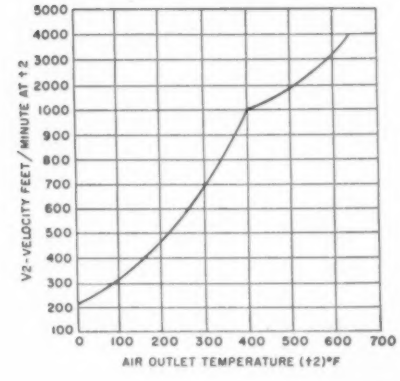
I USE TO DETERMINE LOSSES THROUGH INSULATED WALLS



II USE TO DETERMINE LOSSES FROM ENDS



III USE TO DETERMINE VELOCITY OF AIR



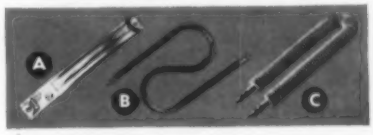
IV This Table Lists Specific Heats

Substance	Average Specific Heat	Weight in Lb per Cu Ft
SOLIDS		
Aluminum	0.23	160
Antimony	.052	423
Asphalt	.40	65
Beeswax	...	60
Bismuth	.031	610
Brass	.10	525
Brickwork and Masonry	.220	140
Carbon	.204	...
Copper	.10	550
Glass	.20	165
Graphite	.20	130
Iron, cast	.13	450
Iron, wrought	.12	480
Lead, solid	.031	710
Lead, melted	.04	...
Nickel	.11	550
Paper	.45	58
Paraffin	.70	56
Pitch, hard	...	83
Rubber	.40	95 ÷
Silver	.057	655
Solder (50% lead—50% tin)	.04	580
Steel	.12	490
Sugar	.30	105
Sulphur	.203	125
Tallow	...	60
Tin, solid	.056	455
Tin, melted	.064	...
Type metal (85% lead—15% antimony)	.040	670
Wood	.45 ÷	34 pine / 50 oak
Zinc	.095	445
LIQUIDS		
Acetic acid	0.472	66
Alcohol	.65	55
Benzine	.45	56
Ether	.503	46
Glue (mixed 2 parts water, 1 part dry glue)	.895	69
Glycerine	.58	79
Mercury	.0333	845
Oil, cottonseed	.47	60
Oil, machine	.40	58
Oil, olive	.471	58
Paraffin, melted	.71	56
Petroleum	.51	56
Sulphur, melted	.234	...
Turpentine	.41	54
Water	1.0	62.5

	At Constant Pressure	At 70 F Atmospheric Pressure
GASES		
Acetylene	0.35	0.073
Air	.237	.080
Alcohol	.453	...
Ammonia	.520	.048
Carbon dioxide	.203	.123
Carbon monoxide	.243	.078
Chlorine	.125	.20
Hydrochloric acid	.195	.102
Hydrogen	3.41	.0056
Methane	.60	.0447
Nitrogen	.245	.078
Oxygen	.218	.09
Sulphur dioxide	.155	.179

Here is condensed information to help you get the most economical electric heaters for your oven and process air design problems.

Generally, strip heaters (a) or tubular heaters (b) are used for natural convection applications. For forced convection heating, fin-tubular heaters (c) are most desirable.



Here's how you figure the amount of heat required:

1. Using the formula, lbs of material × specific ht × temp rise (F) over 3412 = kwh required, figure heat requirements for the conveyor.
2. Using the above formula, figure heat requirements for the material to be heat treated.
3. Figure total area, in square feet, of top, bottom and both sides of the oven. Check Table I to find total kwh losses. Adjust for insulation.
4. Figure area of both end openings in square inches. Multiply times factor found in Table II.
5. Figure in square feet, the area of the duct. Check Table I for losses. Adjust for insulation.
6. Figure cubic feet of volume of oven and duct. Find weight of air at room temperature from Table IV. Multiply your answer times total cubic feet times number of air changes needed per hour. With this answer, use formula from Step 1 above to find kw needed for air change losses.

Total the answer arrived at in the 6 steps above. Add 3 kw as a safety factor. You now know how much heat is required. For more complete information, send coupon below or call your nearest General Electric Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

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Please send GEA-5096, "Heating Process Air" and GEC-1005, "Catalog of G-E Heaters and Devices."

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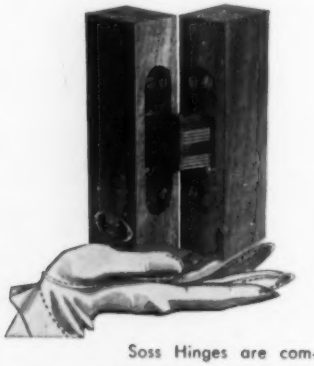

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Reader to Editor...

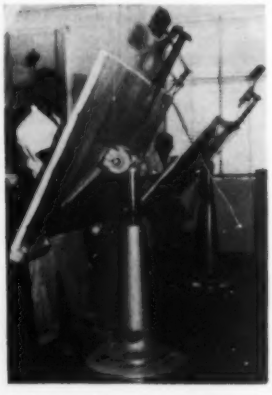
More Important—Brains or Money?

To the Editor:

The letter by Mr. Carl L. Webber of Plymouth, Fla which appeared in your Feb 2 issue, p 20, is quite disturbing in that it appears to attach primary importance to the "money-half" of any development project or invention. Mr. Webber asks, "Who appropriates the capital for the design and development of a project? Who, then, should have the voice as to whether the inventor's name is made public?"

I disagree with Mr. Webber's philosophy. Two ingredients are necessary for successful completion of development work: brains and money. In spite of the fact that both are needed, the "money man" always feels that his contribution is the most important.

I have often wondered whether it is not a secret feeling of inferiority which prompts the "capital investor" to grab the spotlight and to withhold from the inventor the credit that is his just due. We are fortunate that inventors continue to invest despite lack of recognition. Is it not time that we became "big" enough to give them their rightful due in both money and public acclaim? —Thomas Cherbas
Battle Creek, Mich



Caribbean Drawing Board

To the Editor:

I was interested in the modern drafting equipment presented in your issues of Oct 6 '58 (p 28) and Oct 13 (p 68). I was not surprised about the need for this efficiency plan in your country, as I always was astonished seeing even big companies dare to show, in their advertisements, a drafting room filled with "belly-boards."

In Holland 33 years ago, I started in the drafting room of a small company with an upright board and about 23 years ago with a drafting machine. The draftsman you mentioned probably never bought a car, because he is used to pedes apostolorum. It surprises me that PE did not really illustrate modern equipment. We use an easy-movable pedestal or column-type (upright) board. There are also machines without overhung counterbalances, for L-shaped workspace. —G E Lips
Julianadorp Curacao

Static-pressure Transducers

To the Editor:

In your article on static-pressure transducers (Jan 5, p 48) it may be of interest to point out that certain specifications can be held to somewhat better limits than stated in your article. For example, hysteresis of 0.05% F.S. is a fairly common specification for variable-reluctance transducers where there is no static friction. This low value has been obtained after much research into pressure-element materials which show very little elastic hysteresis. By proper design it is also possible to obtain 0.05% linearity. Also since, in a variable-reluctance transducer there is no friction and no potentiometer winding, resolution and deadband are nonexistent and are commonly specified as zero in magnitude. —William J Rihn
Project Chief, Transducer Section
Wiancko Engineering Co

Portable Steamer

To the Editor:

In a recent "Why Don't They Research and Develop" (Nov 17, p 50) a reader asks for a small steam cleaner. In connection with this, there is such a steamer available marketed by Steamax, Philadelphia. —E E Griep
The Metal Ware Corp
Two Rivers, Wis

We Forgot Australia

To the Editor:

It has been brought to our attention that in the "box" on page 29 of your Dec 15, issue, the Commonwealth of Australia is not included as a member of international patent agreements. I thought that you would be interested to know that Australia has been a member of the International Convention for the Protection of Industrial Property since 1907 and was represented at the diplomatic conference in Lisbon late last year when a revision of the Convention was discussed.

—T D Sprod
Liaison Officer
Australian Consulate General NYC

CORRECTION: "Reliability of Electrical Connections," Feb. 2, p 56, next to last paragraph. It should not include "copper with solder-dipped copper" as a poor combination against galvanic corrosion. Actually, this is a fairly good combination, and exhibits only slight corrosion.—Ed.

New Design Versatility with RŌTAC

Compact, powerful Rōtac Torque Actuators have a wide range of applications

RŌTAC Rotary Torque Actuators consist of a cylindrical chamber containing a stationary barrier or shoe, and a central shaft with a fixed vane. With fluid or pneumatic pressure applied to either side of the vane, rotary movement in the opposite direction is obtained; power can be doubled by using double-vane shafts. One moving part insures long life and low maintenance.

Rōtac Actuators can be mounted vertically, horizontally or at any angle, with the housing held stationary or with the body rotating around the shaft.

Wherever you need motion—powerful, easily controlled rotary action in compact form—Rōtac Actuators simplify design and provide unlimited possibilities for use in various applications.

FREE DESIGN DATA BOOK—20 PAGES

Contains everything you'll want to know about RŌTAC—How it works • Control • Typical applications and special uses • Installation details • Dimensions • Torque ratings • Helpful ideas for using RŌTAC Actuators in your operations.

MOBILE EQUIPMENT—A compact RŌTAC Torque Actuator swings this truck-mounted crane boom in a 280° travel arc; it's controlled through a 4-way valve.

MACHINE TOOLS—Automation machine for boring and grooving piston wrist pin holes uses RŌTAC Torque Actuator for positioning the orienting arbors.

FOUNDRY MACHINERY—Ex-Cell-O Model HN-66-1V RŌTAC Actuators supply the motive power for turnover of the core-box on this semi-automatic shell core blower.

PAPER MACHINERY—This collector roll is actuated by a standard model RŌTAC Actuator which unloads material after a slitting operation is performed.

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News about R/A SINCE 1913 **Adhesives**

FOR ALL METALS AND ALL PLASTICS

This "100%-solids" adhesive flows like a heavy-bodied motor oil

TECHNICAL DATA ON

Bondmaster® M648T

A free-flowing, high strength, room-temperature-curing, 100%-reactive, two-component, formulated epoxy adhesive designed for bonding all metals and other rigid materials (such as glass, ceramics, plastics, plastic foams, and structural laminates) to themselves and to each other.

BOND CHARACTERISTICS

Fully cured bonds exhibit minimal shrinkage, are electrical insulators, and provide excellent resistance to weather, galvanic action, and most chemicals, acids, and alkalies.

APPLICATION

Mixed BONDMASTER M648T may be applied with trowel, spatula, knife, roller, brush, etc. Apply enough *mixed* BONDMASTER 648T to fill all cavities and depressions in both surfaces *and* to leave about 4 additional mils of adhesive on each side. Press together firmly to establish and maintain intimate contact, and cure. Pressure is not required during cure.

SPECIFICATIONS

VISCOSITY (mixed): about 10,000 cps. COLOR: clear, pale amber. BASE: modified epoxy. SOLIDS: 100%. HARDENERS: CH-8 for balance of all properties; CH-16 for best shock and peel strengths. WEIGHT PER GALLON: about 10 lbs. STORAGE: 1 year, unmixed. CONTAINERS: 1-gal. cans; 5-gal. pails; 55-gal. drums.

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Don't let the "100%-solids" term confuse you . . . this modified epoxy adhesive is a free-flowing liquid!

BONDMASTER M648T ("T" for "thin") exhibits all the smooth mixing characteristics and ease of handling of a 10,000 cps fluid—can be applied by brush, spatula, roller, spreader, or similar conventional equipment.

As with all BONDMASTER formulated epoxy adhesives, M648T yields high strength bonds on all rigid metals and just about any plastic or plastic laminate. In addition, its lower viscosity makes it ideally suited for work on flexible plastic sheets (like bondable Teflon) or fragile cells of rigid plastic foams (like Styrofoam) as well as on thin metallic foils of all types.

100% REACTIVE

The glue line thickness you put down won't shrink, either during the cure or after it . . . this formulation is 100% reactive. (There is no wait for solvent evaporation either.) Mere contact pressure is sufficient.

CURES AT ROOM TEMPERATURE

A bond that's strong enough to permit handling of your assembly develops at room temperature in from 4 to 6 hours; about 85% of maximum strength in less than one day. Alternately, if you can heat-cure, you can reach full strength far more rapidly—in as little as 10 minutes at 250°F., for example.

WRITE FOR FURTHER DATA

Write for Technical Data Sheet describing this 100%-reactive, free-flowing liquid epoxy adhesive formulation. We will be glad to send a free evaluation sample as well if you will describe your bonding problem in detail.

DEVELOPMENTS TO WATCH...

American

Thermosetting-plastic bearing material that promises to . . .

. . . equal or surpass the load and wear performance of both plastic and sintered-metal "oilless" bearings is now under test. Developed by Arguto Oilless Bearing Co, it has a viscous synthetic lubricant incorporated in the resin mix. Operating temperatures, according to Arguto, will be substantially higher than those for nylon bearings (400 to 450 F as compared to about 350 F) and wear rate is unusually low.

In a typical test of the new Arguto-MP as compared to sintered bronze in 1-by-1-in. sleeve-type bearings under 45-lb load at 1850 rpm and PV of 21,700, the new bearings showed about 3 times the life of the more conventional material.

Price of Arguto-MP bearings will be relatively high—between nylon and Teflon (TFE fluorocarbon plastic)—but improved performance and longer life are expected to make up the difference. (More information on this development will be presented in a future issue.)

Heat-emissive lead compounds may help solve . . .

. . . severe cooling problems in electronic equipment as well as air conditioning and refrigeration, Robert L. Ziegfeld of the Lead Industries Assn reports. Working under LIA sponsorship, researchers at NYU are testing a number of lead compounds (among them, the oxide, sulfide, telluride, and selenide), and report that such compounds can markedly increase the rate of heat emission and dissipation from metal surfaces. Some compounds may be used as paints; others, as electrically activated surface layers.

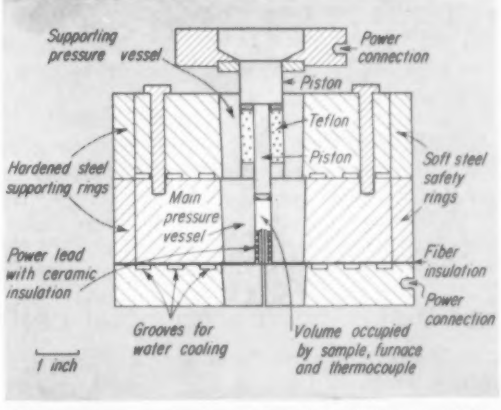
Hydraulic fluids and lubricants for the 700-F range . . .

. . . have been developed by the Wright Air Development Center Materials Laboratory; and American Potash & Chemical now has a contract to set up a pilot plant and to design production facilities for these materials. Says WADC: "The successful completion of this program (target date: Dec '59) will mean availability of . . . sufficient quantities of high-temperature lubricants and hydraulic fluids . . . to enable full-scale engine and hydraulic system testing. enable full-scale engine and hydraulic-system testing." Commercialization is still some distance away though.

Pressures to 50,000 atmospheres and temperatures to 1000 F . . .

. . . are being applied by geophysicists at Carnegie Institute of Washington in an attempt to learn more about how minerals are formed; and, with the apparatus diagrammed here, they expect to maintain pressures of 65,000 atm. or more, and temperatures to 2000 F with an accuracy of 5%.

The CIW researchers are after such information as the change in melting points of minerals under pressure (lithium chloride, for instance, goes from 1100 F to nearly 2000 F as the pressure increases from normal atmospheric to 25,000 atm.); but the design should have much wider application—for example, in studying the effects of high pressures on electrical properties. Changes in the behavior of semiconductors and phosphorescent materials under pressure have already been reported (*PE*—Aug 11 '58, p 10) and there is evidence that high pressures can also affect the conductivity of nonmetallics. Scientists at U of California's Radiation Laboratory report that, at pressures in the range of 160,000 atm., the specific resistance of silver oxide drops by a factor of 30 or more.



High-pressure apparatus designed at CIW has a Teflon (TFE fluorocarbon plastic) supporting structure to back up the pressurizing piston. Bismuth, which undergoes a structural transition (indicated by a change in electrical resistance) at calculable pressures and temperatures, is used for pressure calibration.

DEVELOPMENTS TO WATCH...

Intermittent or pulsed combustion can increase . . .

. . . gas-turbine efficiency and bring fuel savings of 10% or more, says Naval Research Laboratory. Members of its Mechanics Div have been testing a valveless pressure-gain combustor (first described in ASME paper 58-GTP-11); and now report, with an improved design, fuel savings as great as 17.3%. This is at the maximum bleed flow (0.762 pps). Even greater savings for the pulse-jet burners as compared with the conventional type were recorded at lower operating levels. Furthermore, Navy researchers say, the pressure-gain combustor design is "not yet optimized." Further improvement can be expected. The research project (NS 622-210) is continuing.

Ceramic structural materials can be protected . . .

. . . from high-temperature failure by addition of small percentages of such metals as titanium, chromium, molybdenum and zirconium, say Wright Air Development researchers.

According to Dr. Berthold C. Weber of the WADC Aeronautical Research Laboratory, parts made of such materials as zirconia frequently fail by reason of volumetric changes which occur at their transition temperatures. Small additions of metal powder to the composition from which the ceramic parts are made, he says, seem to act as a buffer, permitting expansion or contraction while preventing failure. So far, research has centered on zirconia, with the metal additions noted above, but work is now to be extended to include other ceramic-type materials.

An instrument to measure flavor . . .

. . . is sorely needed, General Mills researchers point out. It should find a ready market in food, drug, and beverage industries—and perhaps in adhesives and other fields as well.

Such an instrument must do more than just tell whether a flavor is "good" or "bad," though. It should be adaptable to process control. As GM puts it, "The central job is not one of esthetic judgment but one of comparison to a standard sample." It's not going to be an easy job. A detectable flavor odor can be produced by one 25-billionth of a drop (4×10^{-11}g) in one whiff (50 cc) of air. The best instrument so far available, a modified vapor phase chromatograph, can only analyze samples of the order of 1/50 drop. No wonder, then, GM says, "The best 'instrument' for measuring and controlling flavors is still a panel of people."

As might be expected, odor-measurement, too, is a major problem—in air pollution control and many other operations as well as in foods and drugs. Here, instruments have been developed; but there is still room for one that does an accurate over-all job.

Unusual carbide fibers can be made . . .

. . . Bjorksten Research engineers believe, by taking advantage of techniques already developed for producing vitreous silica fibers and, says Bjorksten, "they should be more favorable than oxide fibers for reinforcing metals at high temperatures" (*PE—Jan 5, p 22*). They should have less reactivity at high temperatures; they might prove useful in special papers and electrically conductive blankets.

The silica fibers themselves, Bjorksten says, have a melting point of 3110 F, and equipment used to produce them can function satisfactorily at temperatures above 5000 F.

(Note: For more on exciting new developments in silicon carbide, see *PE—Mar 2, p 20*; and for more on silica fibers, *PE—June 9 '58, p 20, and July 7 '58, p 70.*)

For better powdered-metal parts . . .

. . . check porosity and the factors which influence it, says Dr. H. H. Hausner, AEC consultant. This long-neglected factor may play a far more important role in powder metallurgy than previously supposed. It can determine the grain structure, and therefore have a major effect on the physical properties of the sintered product.

As he pointed out to a recent Los Alamos meeting, porosity—the amount of space between metal particles—affects both the diffusion which governs densification and the grain boundary movement that controls final grain structure of the finished product. Furthermore, he notes, there are at least 10 variables that enter into this one characteristic. Among them; pore size, shape, orientation, interconnection, volume, and total number. —ARC

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In the Lawnsweeper shown at left, made by Lambert Incorporated of Ansonia, Ohio, wheels and internal gears of Kralastic are not only rustproof, light in weight, and permanently colored, but the use of Kralastic actually eliminated *5* separate manufacturing steps.

The Kralastic grass catcher at right, made by the Jacobsen Mfg. Co., of Racine, Wisconsin, was tested at temperatures from 10°F below zero to more than 100°F above—was unharmed by small objects hurled against it at 200 mph. Kralastic's dimensional stability even in these large vacuum-formed sections allows clean, product-selling contours. And with its sound-deadening properties, this lighter-than-aluminum catcher keeps quiet on the job.

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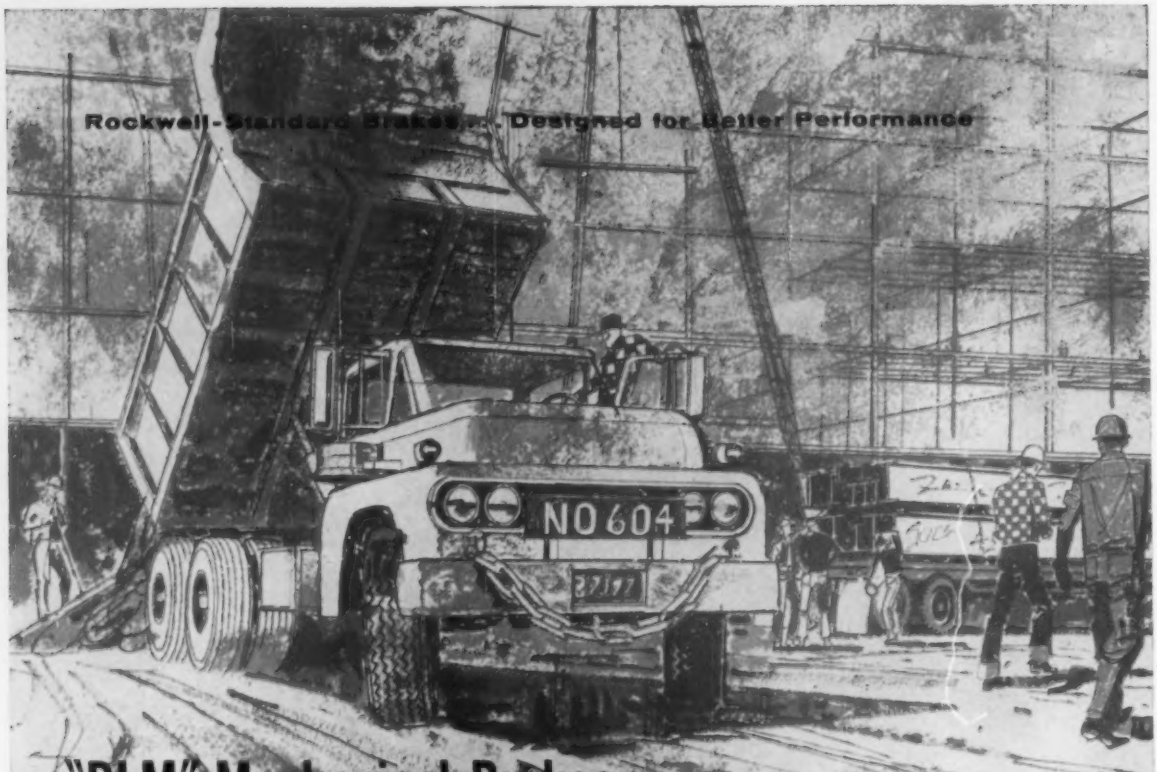

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DEVELOPMENTS TO WATCH...

World-wide

A burglar alarm that calls the police . . .

. . . at the same time it sounds an alarm on the burgled premises has been designed by the Milan, Italy Police Headquarters (Questura Centrale) staff. It can be built from relatively standard components and activated by a broken electrical circuit, an infrared detector, or even a loud noise.

When the system is activated (one or more contacts may be installed as desired), an automatic telephone selector calls the police station and automatically supplies the name and address of the property being burgled. The telephone selector is controlled by a punched card on which the police station number is recorded; and a photographic transmission unit with a recording disk is arranged to repeat the name and address the desired number of times when the station answers the call.

To assure protection even if the burglar is smart enough to cut the telephone lines, an auxiliary battery is built into the system, and there is provision for automatic switching to this standby power source.

Paper that's even stronger wet than dry . . .

. . . is claimed by Societe Snia Viscosa, Milan, Italy. A combination of synthetic fibers and resins, it's said to have a tear resistance of about 2.5 lb/in. when dry; 4.8 when wet. Tensile strength doesn't increase when the material is damp; but it drops relatively little—less than 25%. In addition, the company says, the paper has good fold-resistance, and takes printing well. (For information on US developments in synthetic fiber papers for engineering application see *PE—Feb* 16, p 50.)

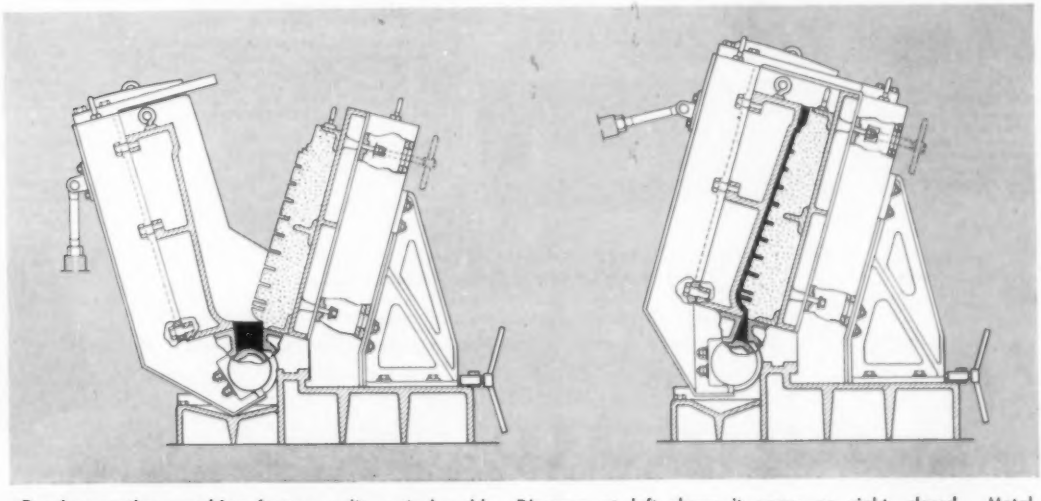
Ribbed nonferrous metal sheeting is being cast to shape . . .

. . . in the USSR, with an unusual machine built around a pair of mechanical jaws.

The Russians describe the machine as a scissors-type press-casting unit with two upright sections pivoting around a horizontal floor-level axis. One of the halves bears the ribbed impression; the other is flat. Molten metal is poured into a tank located just above the pivot axle, and then shot into the mold just as the flat half is pressed against the ribbed section. Ridges and grooves form a tight enough seal to prevent escape of the metal because the pressure applied is less than 10 psi.

So far, the Russians say, sheets up to 75 sq ft in area and nearly $\frac{1}{8}$ in. thick have been produced; but they believe much larger and thicker sheets are possible.

Advantages, say the Russians, are vastly increased rates of production, low power requirements, and low cost. Projected uses: truck and railroad car flooring, dump truck hoppers, machine housings. —ARG



Russian casting machine features split vertical mold. Diagram at left shows it open; on right, closed. Metal is forced upward from tank atop pivot at base. Output is said to be surprisingly high.

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THE SAGINAW b/b SCREW

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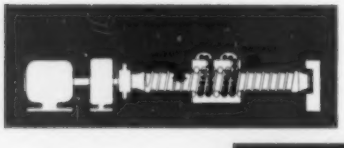
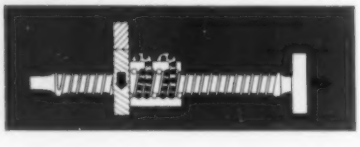


NUT TRAVELS: When rotary motion is applied to the screw, the b/b nut glides along the axis of the screw on rolling steel balls, converting rotary force and motion to linear force and motion with 4/5 less torque than acme screws.

SCREW TRAVELS: When rotary motion is applied to the b/b nut, the screw glides along its longitudinal axis on rolling steel balls, converting rotary force and motion to linear force and motion with unprecedented efficiency.



1. **SAVES POWER.** Operates with almost 100% efficiency. Saginaw b/b Screws permit much smaller motors with far less drain on electrical systems, also simplify circuitry.
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Available in custom machine-ground and stock rolled-thread types. Units have been built from 1½ inches to 39½ feet long—⅛ to 10 inches in diameter.

Saginaw ball bearing Screws and Splines

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WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

The impact of the space age . . .

is beginning to be felt. Space Administrator T. Keith Glennan told Congress recently that "this is the last time" the agency will ask for budgets of less than one-half billion dollars. In future years, Glennan said, the space program will cost more and more —soon topping a billion a year. Results, although impossible to measure at this time, should well offset costs, however.

The money will go for such things as communication satellites, space stations, manned space flight, etc. Plans call for developing a whole new family of rockets that will be capable of carrying 25 tons of payload to Mars, making round trips to the Moon, and exploring Venus.

Over $100 million in R & D contracts have already been let to support these projects, with another $120 million slated to be given to industry by June 30th.

In 1960, the National Aeronautics and Space Administration plans to spend another $330 million for R & D. Its total budget for next year amounts to $485.3 million.

Here is where the money will go: around 20% will go to space propulsion technology, including development of solid fueled rockets, high energy fuel rockets, the one and one-half million pound thrust single chamber nuclear rocket engine and auxiliary power units.

Some 50% will go for procurement of vehicles and instruments covering sounding rockets, earth satellites, lunar probes, and deep space research.

About 20% will be channeled toward manned space flight, including construction of the first manned space capsule for project Mercury. Around 6% will be for specific investigations of satellite use in the field of meteorology and communications. The balance of the money will be used for tracking and data acquisition, and new research.

R&D contracts that have been let . . .

by NASA are the following: to Jet Propulsion Lab, $8.2 million, for general research; $23-million to Naval Research Lab for Vanguard support; $40,000 to Iowa State Univ for space probe instrumentation; $140,000 to Minneapolis-Honeywell Regulator Co to furnish automatic flight-control systems for manned space flight; $110,000 to Douglas Aircraft Co for propellant tank assemblies for high energy fuel rockets; $180,000 to Solar Aircraft Co for rocket thrust chambers and the necessary tooling for high-energy fuel rockets; $70,000 to Acrolab Development Co for booster hardware for manned space flight; $400,000 to North American Aviation Missile Div for transport vehicles and launcher to support manned space flight; $120,000 to Smithsonian Astrophysics Lab for photo reduction equipment; $470,000 to Smithsonian Institution for tracking and data reduction; $1.9-million to the Atomic Energy Commission for nuclear rocket engines in support of project Rover; $10-million to Rocketdyne Div of North American Aviation, Inc to develop a one-million pound thrust, single-chamber engine; $2.1-million to the Army for a 100-ft inflatable sphere in support of communication satellites; other similar contracts.

New space vehicles . . .

the NASA is developing: by mid-1960 it plans to start a new "work horse" vehicle, dubbed Scout, at Wallops Island, Virginia. To be entirely solid fueled, its cost will be around $450,000—about one-fifth of present vehicle costs.

Scout will be a four-stage vehicle capable of putting 150-lb payloads into 300-mile-high orbits, and 100-lb payloads out to 4,000-mile orbits. It will be used extensively for jobs like communication satellites.

Within the next couple of years NASA says it will have two other space vehicles in use—Vega and Centaur. Both are three-stage rockets that will be capable of putting 1,000-lb payloads to Mars, and 6,000 lb satellites in orbit around the earth.

Within the next 4 to 5 years a new generation of rockets will be developed. Still unnamed, one will be a five-stage rocket that can send 20,000 lb to the moon. The other will be a six-million-lb thrust, five-stage rocket that can carry 2,000 lb to the moon and back; 7,500 lb to Mars with a 750-lb return load.

The NASA hopes to have a nuclear powered rocket developed by then, too. If so, it will be used as an upper-stage rocket and increase the capability to carry 55,000 lb to Mars with a 25,000-lb return load.

Cold war in "hot" alloys

In materials for nuclear-reactor construction, it seems the Russians climbed our stairway, while we built a cheaper–but less-effective–ladder.

Zirconium alloys for nuclear fuel elements and other structural purposes were first developed in the US, and they offer great advantages in neutron economy as compared with stainless steel. Recent reactor designs, though, have tended to use stainless alloys instead of zirconium, apparently because they are cheaper (in fabrication cost) and easier to use.

Latest reports from Russia, on the other hand, show the opposite trend. The Soviets are not only using US-developed zirconium alloys, but are also developing new ones, with columbium as the primary alloying element.

Now, apparently, we're to turn around and follow them.

W. H. Zinn in a recent AEC report on Power Reactor Technology, and the AEC's Ad Hoc Committee on programs and policy both recommend the reversal; particularly since the price differential between zirconium-jacketed and steel-jacketed fuel elements appears to be less than was originally supposed.

Sign-of-the-trend is the fact that, only recently, the AEC awarded a good-sized zirconium-columbium alloy development contract to Case Institute of Technology.

briefs . . .

Why do metals resist rupture in air for longer periods than in vacuum–at least at high temperatures and low stresses? Naval Research Laboratory metallurgists, having demonstrated the effect, are now trying to explain it. Their theory: Oxidation at high temperatures sinters crack surfaces together, thus increasing the load-bearing area and, in effect, repairing the results of stress damage. Study of nickel specimens at 1500 F seems to bear out this idea. Though preliminary tests show a good deal of scatter in creep-rupture endurance values, the results are promising enough to warrant further study.

Standard solar cells: For calibrating artificial light sources in terms of solar energy, International Rectifier Corp is now supplying standard silicon units. The cells, says IRC, have a conversion efficiency of at least 9% and are supplied with calibration curves indicating their conversion efficiencies at specified radiation intensities and temperatures. Price of the cells, with special carrying case and calibration chart, is about $50.

Metals for the lab: Unusual demands for precision-rolled metals will be welcomed by American Silver's new Industrial Laboratories Div, set up specifically to supply development engineers with "comparatively small quantities of precision-rolled metals of unusual specifications" for the production of prototype models. They'll roll almost any metal, hold tolerances in the millionths.

Standard test specimens that can help correlate studies in different laboratories of the stresses created by such "environments" as ozone, solar radiation, and high humidity, are being developed by Inland Testing Div, Cook Electric Co. for the Air Force. Inquiries and suggestions are welcomed. Address Paul Gottfried, Code 011.

Quotable quotes on basic research are collected in an attractively printed Brief Anthology published by Mellon Institute. In its 12 pages are nearly two-score items, and these are up-to-the-minute quotes, most gathered from speeches and writings of the past two years, and many from personal communications.

Russian instrumentation research reports will be made available in English by Instrument Society of America under a program sponsored by the National Science Foundation. Four translated Soviet technical journals will be obtainable on subscription.

The organic-moderated reactor, one of the newest and most promising systems for nuclear power-production, propulsion and heating, is described in a full-dress report prepared by Atomics International Div, North American Aviation. In the AI organic-moderated reactor design now undergoing operating tests, the organic (polyphenyl) compounds serve not only as moderators (to slow down the neutrons so a chain reaction can occur), but also as shielding and coolant. The report, now in the form of a 24-page color brochure, is obtainable on request.

–ARG

Movies for R&D

Sporting a new 2-sided prism shutter that provides "faster effective shutter speed and gives increased stopping action at any frame rate," this high-speed motion picture camera is specifically designed for studying clutches, gears, electrical contacts, switches, relays, and other operating mechanisms. It has a shutter speed range from 150 to 6000 pictures/sec; takes 100-ft spools of 16mm film. Price: about $2000. Manufacturer: Wollensak Optical Co.

New camera, styled for the lab, features synchronized rotating prism, has viewfinder, timing light, cutoff switch, and provision for slit apertures.

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Faultless L900 Casters

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CUT YOUR HANDLING COSTS 3 WAYS

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Cushion tread and Semi-Pneumatic wheels give extra protection to loads and floors. Other types of wheels available.

SURPLUS STRENGTH SAFELY HANDLES MAX. RATED LOADS

GREATER MANEUVERABILITY
Two full rows of ball bearings in swivel head assure easier handling, in confined areas.

NOELTING **Faultless** Casters

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2. **MAIN LOAD BEARING** . . . consists of 21 hardened, polished balls (⅜" dia.) rolling in large dia. hardened, lubricated raceway permanently attached to caster horn to assure perfect alignment.
3. **LOWER THRUST BEARING** . . . contains 10 hardened steel balls (⅝" dia.). Hardened raceway is machined from bar stock. Ball retainer is hardened formed steel.
4. **EXTRA-LARGE DIAMETER KINGPIN** . . . assures bonus strength in this caster, and strong, trouble-free construction.
5. **CLOSE FITTING, FORMED STEEL CUP** . . . protects thrust bearing from dirt, water and other foreign matter. Holds lubricants in bearings, keeps floor clean.
6. **HEAVY GAUGE, FORMED STEEL HORN** . . . easily absorbs highest rated loads and thrust. Correct offset permits easy swiveling and shimmy-free running.
7. **FULL SELECTION OF WHEELS** . . . for all types of floors and operating conditions. Bolt and nut axles permit quick wheel replacement when needed.

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WHAT'S HAPPENING IN... Materials

More silver for your product?

Silver can help meet the tighter specifications posed by nuclear reactors, auxiliary power sources and new electronic devices, says Ralph L. Wilcox of American Smelting & Refining. Improved solders, electrical contact materials, battery compounds and structural alloys are coming along fast.

For high-temperature soldering, there are now silver-copper-lithium alloys (92.5%, 7.5%, 0.03%) that show decidedly improved wettability. Silver-palladium-manganese alloys, developed in Europe, also promise improved wettability and higher strength.

Silver-coated copper wire, insulated with Teflon, is being used for aircraft and electronic equipment that must operate in the 500-1000 F range.

A silver-indium-cadmium alloy (80%, 15%, 5%) for nuclear-reactor control rods is said to show good irradiation stability, thermal conductivity and corrosion resistance. However, its resistance to plastic flow under static loading is not as good as it should be. Efforts are in progress to improve it.

Note: For those interested in the over-all production and marketing aspects of this metal, Handy & Harman's 43rd Annual Review is now off the press; may be obtained from H&H, 82 Fulton St., New York 38.

Need materials? Look to the sea

Our oceans got a big boost as a future source of materials with the International Geophysical Year finding of vast ocean-bottom deposits of valuable minerals. At the same time came promises of "limitless power from the sea" through thermonuclear reactions.

It will likely be many years before the power promises come true. Heavy hydrogen for thermonuclear reactions is certainly available in quantity in the oceans of the world; but its use as a fuel is a lot further off than the headlines indicate.

But the oceans can be tapped—and soon—for many vital minerals. Already, we get magnesium from the sea, and there are many other materials that could be obtained if efficient chemical processing techniques were developed. But mining may be an even faster route. The newly discovered sludge deposits are said to contain such metals as manganese, cobalt and copper "in concentrations suggesting an ore value of half a million dollars a square mile," recoverable by relatively simple dredging operations.

New equipment, and lots of it, will be needed to do the deep-sea dredging job; and there has to be an incentive to get operations started. But the starter button has been pressed, the National Academy of Science is recommending a $78-million, 10-year research program, and a good deal of activity by nongovernment agencies can be expected in this field in the next few years.

Stearate beefs up plastics and paints

A US Dept of Agriculture citation to seven of its chemists focuses attention on a chemical likely to be much in the news from now on. The compound they developed: vinyl stearate. It can be made from waste fats, and used in water-based paints, plastics, and adhesives. Combined with other resins, it promises new lube oil additives, wire and metal coatings, and paper and textile sizes.

Plastic sheeting compounded with vinyl stearate, USDA says, is "stronger, more flexible, and more durable in temperature extremes than plastics we've made before." Paints, too, show an unusually smooth surface and good durability.

First commercial producer of vinyl stearate is Air Reduction Chemical Co; and, while demand is still not high by industry standards, both USDA and Air Reduction are actively engaged in applications research and confident that consumption will grow as the potential of the new compound is explored.

Steel: growth without change

Productive capacity for steel has increased some 40% since 1950; yet there have been surprisingly few major changes in the steel picture.

In a Paley Report symposium at the AIME annual meeting, John D. Sullivan of Battelle Memorial Institute notes that a comparison of current figures with those at the time the President's Materials Policy Commission prepared its report shows differences of degree rather than kind.

"Various technical advances, such as vacuum casting" he says, "are beginning to take hold but as yet they produce a minor percentage.

"Continuous casting and hot extrusion, looked on in the Paley report as likely to grow, have not made major progress in the US, though they seem to be getting more attention in Europe and Canada."

Steel's resistance to change is found on other levels as well. Reporting to the same meeting, R. H. Gautschi and F. C. Langenburg of Crucible Steel noted that rare earth additions, so effective in changing the properties of some of the lighter metals, seem to have little or no consistent effect on stainless steel. The reason, apparently: the rare earths don't stay put.

"Chemical analysis of Type 310 stainless steel to which rare earths have been added," they say, "indicates the rare earth content drops very rapidly within the first few minutes after the addition . . . even though care is taken to maintain a protective argon atmosphere over the liquid metal surface." This means that ingot size, variations in holding time, and other factors may have more effect than the rare earths themselves.

—ARG

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DAPON resin molded parts exhibit outstanding stability under extreme conditions of exposure to heat and humidity. Under such conditions they do not crack or change shape. For example, after several months exposure to boiling water, DAPON resin molded cups show no degradation of any kind. DAPON resin molded parts are serviceable at temperatures up to 400-450°F. Higher temperature modifications of DAPON resins are currently under development.

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DAPON resin exhibits almost no shrinkage during cure and no shrinkage following cure. The lack of post-mold shrinkage makes possible formation of complex matching parts with close tolerances and small or large metallic inserts without cracking.

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DAPON resin compounds are extremely resistant to acids, bases and organic solvents even at high temperatures, as well as to staining and color degradation.

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DAPON resin molded parts are noted for the retention of their excellent insulation resistance, dielectric strength, and arc resistance even after exposure to high humidity and to elevated temperatures. DAPON resin's unusual chemical stability insures absence of breakdown and attendant corrosion of metallic electronic components under the most severe conditions of use. DAPON resin is unmatched by any other plastic in this regard.

Color Stability

DAPON resin can be compounded in pastel colors which exhibit greater color stability at elevated temperature than any other known colored plastics.

For Help In Solving Your Problems

Write today for technical literature detailing properties, uses and methods of application for DAPON resin.

***DAPON** Resin is Food Machinery and Chemical Corporation's registered trade name for its brand of diallyl phthalate prepolymer. Names of compounders of DAPON resin molding powders are available on request.

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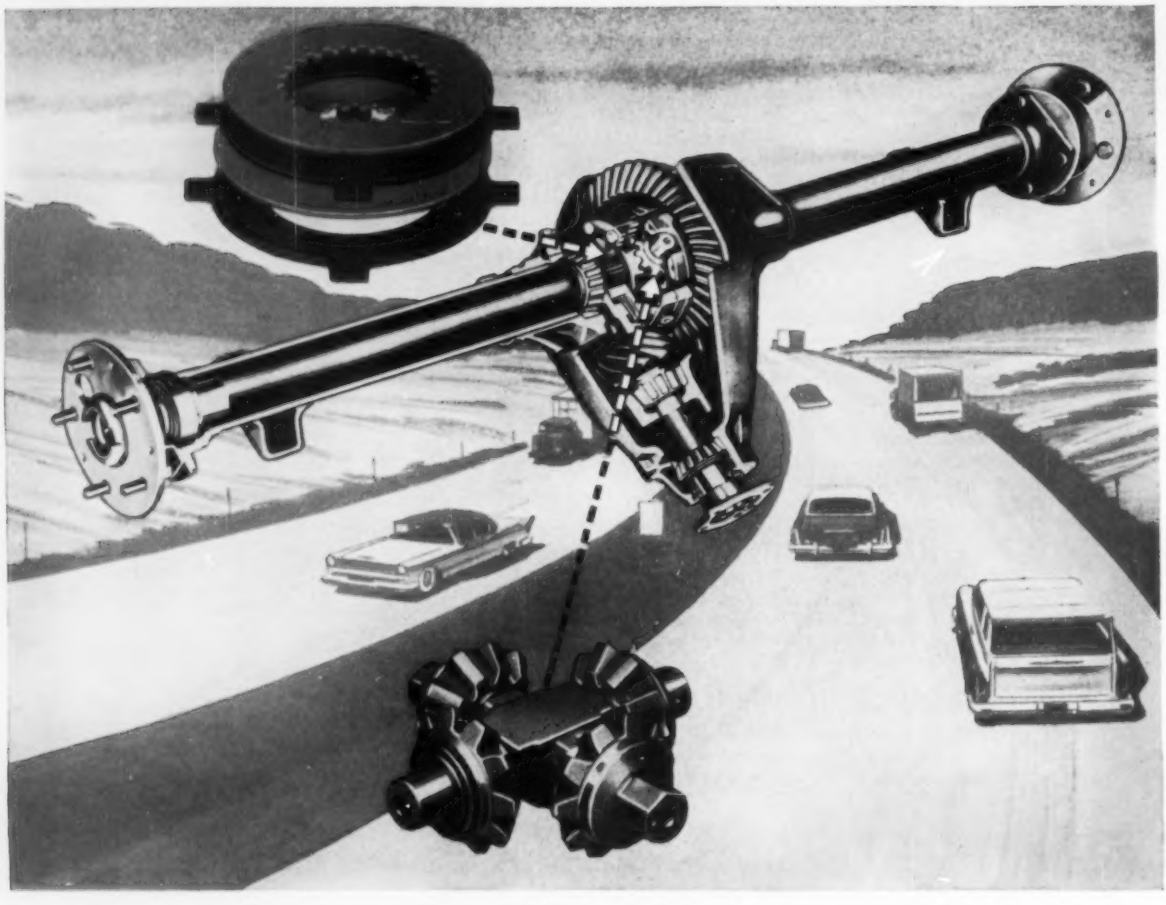
Problem-Solving Products from Republic

PROVIDE SUPER TOUGHNESS AND STRENGTH AT CRITICAL POINTS IN AUTOMOTIVE DIFFERENTIALS



Modern passenger cars with increasing horsepower present problems in high speed stability and handling. The Powr-Lok differential, developed by the Dana Corporation, Toledo, Ohio, permits an automotive axle to transmit the greatest driving force to the rear wheel having the better traction.

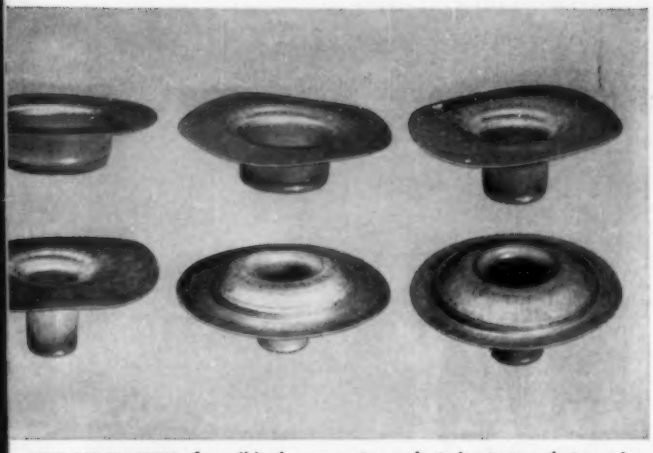
Essential to the economical and dependable operation of these differentials are Republic Alloy Steels. Why? Because only alloy steels have the high strength, toughness, shock-resistance, and abrasion-resistance needed to withstand the severe service to which differential clutch rings and side gears are subjected.

By specifying Republic Hot Rolled 8615 Alloy Bars, Dana engineers have reduced the possibility of a mechanical breakdown to an absolute minimum.

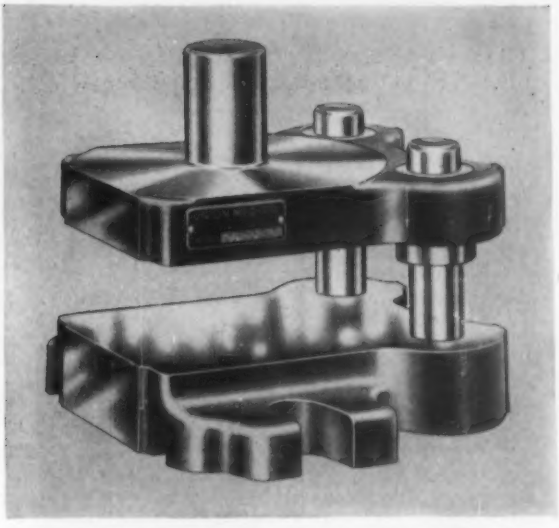
These fine steels offer superior toughness and strength to withstand torque, fatigue, shock, and stress. Alloy steel's uniform response to heat treatment gives these rings and gears hard surfaces around tough cores providing maximum resistance to abrasion, friction, and wear.

In Republic Alloy Steels you will find highest strength values—plus an exceptionally high strength-to-weight ratio that permits the designing of thinner sections to save weight and hold down size without any sacrifice of needed strength.

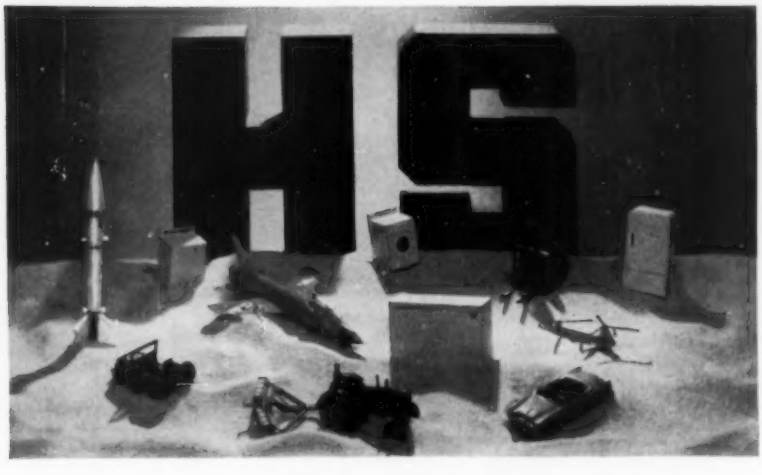
Republic's 3-Phase Metallurgical Service—field, mill, and laboratory—is always available to help you apply these quality alloy steels to your product. It's confidential. There's no obligation. Send coupon for more information.



HERE ARE SIX STEPS of possibly the severest manufacturing torture that a galvanized steel sheet can take. In its final form, it becomes the end piece of a muffler manufactured by the Mackenzie Muffler Company, Inc., Youngstown, Ohio. It is made out of Republic Continuous Galvanized Sheets. Despite the many deep drawing operations, the coating does not crack, flake, or peel. Republic Galvanized Sheets can do a profitable job for you. Clip the coupon and mail it in for more information.



REPUBLIC CHATEAUGAY PIG IRON meets demands for both strength and accurate machining in die sets manufactured by the Union Manufacturing Company, New Britain, Connecticut. As a result, Union has standardized on Chateaugay, low phosphorus, copper-free pig iron for maximum strength, flaw-free, easy-to-machine castings. Other superior characteristics of Chateaugay include its exceptional fluidity, even cooling, and fine dense grain structure. For complete information mail coupon.



REPUBLIC'S NEW HIGH STRENGTH POWDER, TYPE H.S. 6460, opens the way to new markets for new applications using sinterings for highly stressed parts. Type H.S. 6460 can be used with existing operating equipment. It provides a minimum tensile strength of 60,000 psi at 6.4 density as sintered, and 100,000 psi heat treated. Type H.S. 6460 maintains its dimensional characteristics after sintering—less than .004 inches per inch shrinkage from die size at 6.4 density. Available in production quantities up to and including 12 tons, or in multiples thereof. Mail coupon for technical data sheet on Type H.S. 6460 Powder.

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Have a metallurgist call.
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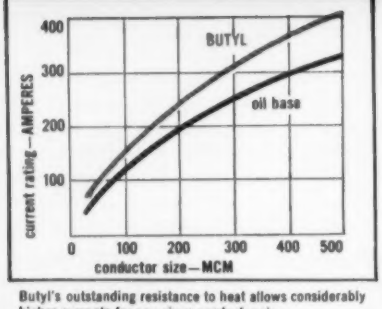
ENJAY BUTYL

BEST WAY TO HANDLE ELECTRICITY



Butyl's outstanding resistance to heat allows considerably higher currents for any given conductor size.

Of all vulcanizable rubbers, Enjay Butyl offers the best electrical and dielectric properties. Butyl is the ideal material for wire and power cable, transformers, tapes, busbars and other insulation applications.

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Product Engineering

HORIZONS

March 9, 1959

"Drei Minuten"

I watched the first V-2 fired at White Sands in 1946, and was surprised to find only the jet venturi—almost intact—in the 30-ft pit made on landing. When everything else disintegrated, how did this one corset-shaped assembly, which had also to withstand the 5000 F flame of the drive jet, withstand the impact explosion? Of course, incoming liquid oxygen and alcohol were passed around it for cooling on their way to the jets, but even so . . .

Ordnance officers were still too unfamiliar with the huge missile to answer my questions about the venturi material, but a German specialist said simply "Stahl." I said: "Steel, eh? What kind of steel?" He shrugged and said, "Eisen stahl" (iron steel). "You mean that this venturi is just carbon steel? Then how can it possibly stand the jet temperature?"

His reply was classic: "Drei Minuten"—and he held up three fingers so I couldn't misunderstand. Here it was again; the American engineer, reared on the one-hoss shay philosophy of best materials all along the line, had forgotten that design life of a V-2 is only three minutes. This is ample, because service life, maximum, for the power plant is 63 seconds, 6 seconds of that before take-off and 57 seconds in flight. There was no need for high-strength materials there, just as there was no need for heavy, long-service design elsewhere. In fact, long-service design would have kept the V-2 on the launching pad.

I am reminded of this occurrence by conversations with present-day missile designers. They point out that minimum weight, low factors of safety and maximum reliability *for the service life* must be wedded in a missile. Weight, for example, is at least as important again in a missile over an airplane, as it is in an airplane over an automobile, because added ounces mean a disproportionately large number of miles of reduction in range.

But to attain reliability, the government tendency is to test, test, test. Thus a missile sub-assembly may have to withstand a 500-hr life test, on the faulty assumption that it proves reliability. The sub-assembly need last only 30 seconds or so, so a design life of five minutes is plenty, and a design for longer life may be too weighty, too costly, and—paradoxically—too unreliable.

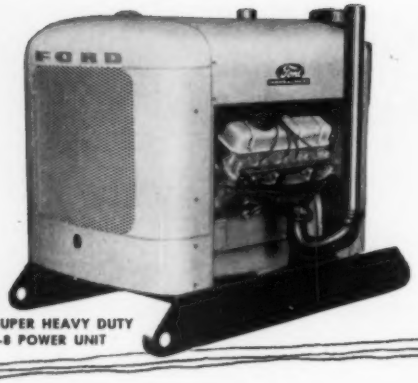
Take a shaft bearing for example. It can be an elaborate anti-friction bearing with a pressure lubricating system. Or it can be just a board with a hole in it. The board with the hole is sure-fire for five minutes, but probably will fail in ten. It certainly will not stand up against any lengthy testing. Like a firecracker, its first test is the last.

The elaborate bearing will give almost endless service—but is subject to minor service failures: tube leakage, pump failure, valve trouble, bearing or lubricant contamination, and so on. It is sophisticated, complex, easy to maintain, and will withstand hundreds of hours of testing. But it is the wrong design for the job.

German engineers on the V-2 were forced to use simple materials and designs because of shortages. But they were not short of ingenuity and horse sense, so they used plenty of these in their designs. And in wartime, they were not hampered by well-meaning and experienced civil servants who knew airplanes but not missiles, who, as one engineer put it, "fly an airplane with a factor of safety of 1.5 across the country to protest that a new design must have a factor of safety of 4."

Perhaps someone should provide these people with another motto to hang beside "Think." This one could be quite decorative, showing in German characters the words "Drei Minuten."

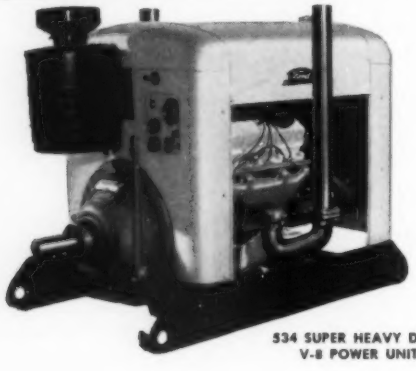
330 DIESEL SIX-CYL. POWER UNIT



401 SUPER HEAVY DUTY V-8 POWER UNIT

Announcing...the addition of four new FORD Heavy Duty Power Units!

477 SUPER HEAVY DUTY V-8 POWER UNIT



534 SUPER HEAVY DUTY V-8 POWER UNIT

Now . . . all Ford Industrial Engines are available as engine assemblies or power units!

● These four new power units are built to handle your toughest work dependably and at low cost. Now from 134 to 534 cubic inches, there's a Ford power unit *right* for your job. The Super Heavy Duty V-8's, for example, offer many advances like fully machined combustion chambers, new fuel and lubrication systems, and more horsepower per pound of engine weight than ever before.

Ford power units and engine assemblies are available with SAE housings, HD power take-offs, and 5- and 8-speed transmissions. The 3 Super Heavy Duty V-8's can be equipped with a new 6-speed Transmatic Drive. And for fast parts delivery or on-the-job repairs, remember, there's always a Ford Dealer nearby to give the service you need *when* you need it.

220 DIESEL 4-CYL. POWER UNIT

134 4-CYL. POWER UNIT

172 4-CYL. POWER UNIT

223 6-CYL. POWER UNIT

272 V-8 POWER UNIT

332 V-8 POWER UNIT

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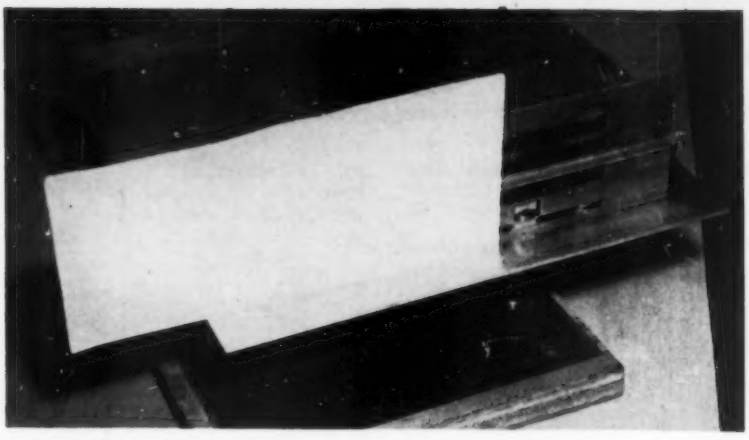
YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED!



Passing the coder . . .
at 90 in/sec. the letter is magnetically coded for automatic handling. Two rubber-rimmed wheels and three rubber belts are in vacuum chamber. Air suction keeps letter in close contact with standard magnetic head (in center, below bottom rubber belt) while belts and wheels move letter along.

New Magnetic Coder Tested for Automatic Mail Sorter

WASHINGTON—A new method for magnetically coding addresses on letters that will be sorted automatically by mechanical means is being tested by the Post Office Dept. If accepted, it will replace the inked dot method (see below), and permit postcards to be coded and handled by the automatic sorter.

The new coder was designed by Rabinow Engineering Co., Washington, D. C. Rabinow Engineering also is the designer of the letter sorter, 10 of which are now being manufactured by Burroughs Corp. According to reports, the first sorter will be ready for shakedown tests by July.

Magnetic pulses replace dots . . .
on a new magnetic coder being tested for use with automatic mail sorting machines. Inked dot method must be used on back of envelope at top. New magnetic coding method requires only thin dark band on front of envelope at bottom.

HOW IT'S DONE

The letter is sprayed with a thin strip (about 2 in. long and ¼ in. wide) of magnetic ink, similar to that used on checks. The coding operator reads the letter, types the abbreviated address, or code, on an ordinary typewriter keyboard. This code is recorded in binary form, stored in a computer register, and eventually is magnetically recorded onto the strip of sprayed magnetic material. This holds a code of positive and negative pulses, with about 30 pulses to the inch. In spite of the fact that the magnetic strip is thin enough to be transparent, the reading head puts out a signal of several millivolts. Air suction is used to insure intimate contact between the piece of mail and the writing and reading heads.

Rabinow says that some of the advantages of the magnetic coding system are that it can be applied to the front of the envelopes without obliterating any part of the printed information; post cards can be automatically sorted (initial design of the coder prevented this because of the multiple dot code on the back of the post card; outgoing code is changed to incoming code by writing over the other.

Aluminum Sub to Study Ocean Bottom

WASHINGTON—Within the next couple of years, an aluminum submarine may be used to explore the bottom of the oceans. Reynolds Metals Co has unveiled its plans to build such a vessel to be dubbed an aluminaut.

As Reynolds plans it, the aluminaut will be some 48 feet long, with a 30-foot cylindrical hull made of 6-in. aluminum plate. Its 7-ft inside diameter will accommodate a pilot and two scientific observers, together with more than 3,400 pounds of scientific equipment. There will be two small viewing ports in the bow of the vessel that could also be used to house television cameras.

The aluminaut's batteries will drive a stern propeller for normal propulsion, and a vertical propeller for ascending and descending. The sub will have a speed of 3 to 4 knots and a range of around 100 miles. It is given a 36-hour submerged capability to depths of around 18,000 feet. Cost of the vessel has been estimated at around $2-million, depending upon the instrumentation.

The US Government agencies and private institutions together have only a handful of research vessels. The only US subsurface research vessel is a small bathyscap acquired last summer by the Navy from the famous Piccard father and son underwater research team. It can submerge to around 18,000 feet, but unlike the proposed aluminaut, is not maneuverable.

Although ocean depths go to 35,000 to 40,000 feet, it is estimated that about 60% of the ocean floor lies above the 18,000-ft diving range of the bathyscap and aluminaut.

Reynolds has developed its submarine ideas entirely independent of government support so far. Southwest Research Institute, San Antonio, Texas, has done most of the research on the project.

Soviet Technical Progress Pressing US Abroad

- **USSR trade in engineered goods is small—but spurred by many agreements.**
- **Soviets offer oil equipment to Argentina, autos to Greece, cut-rate machinery to Uruguay.**
- **They seek machine tools, chemical process equipment, electronic gear from West.**

NEW YORK—In volume, Soviet trade is small—but the trend is up. Exports and imports with the Free World mounted to $2.2 billion in 1957—a gain of about $450 million (25%) over the previous year. Final tally for 1958 is expected to show a further 10-15% gain.

Trade in engineered goods is a small—but again growing—portion of Soviet trade. In 1957 the USSR imported $221 million worth of machinery and transportation equipment from the West and exported $40 million. (They also imported $750 million from Communist bloc nations). The great bulk of Russia's machinery exports go to underdeveloped countries of Latin America, Asia, Africa and the Near East.

Imports generally originate with highly industrialized trading nations—especially Britain and her Commonwealth countries, West Germany and other European Economic Community Powers.

Greece signed a long-term treaty in July 1958 calling for a mutual exchange of $17.5 million worth of goods in 1958, $21 million in 1959 and $24 million in 1960.

Thus far, the Greek imports from Russia have been too slight to permit comparison with Western counterparts. A sizeable number of automobiles—$205,620 worth between January-October, 1958—of the "Moskvitch" type have sold in Greece chiefly because their price tag is 15-20% below their German or British equivalents, and they are bought on easy terms. The owners complain of shoddy finish and frequent breakdowns of the electrical system and wiring. But a troublesome shortage of spare parts last year is now improving.

Generally speaking, Greek officials and businessmen do not believe the Russians will offer serious competition to Western-engineered products.

Soviet commercial ambitions in Argentina are fueled by oil. A trade mission of the Arambu administration received an offer of oil machinery and equipment from the Soviets early last year. It was refused, because the machinery did not meet specifications. The Soviets later made a second offer. This was a $100 million equipment purchase credit good for 10 years at 2½% interest. The agreement was accepted, though it is thought to be of limited practical value.

Argentina has sent trade missions to Iron Curtain countries seeking engineered goods. These include: transmission and other electron tubes; chrome and molybdenum valves; rails; thermocouple wire; diesel electric locomotives; electric motors; high pressure boilers; motor chassis and auto spare parts. The missions failed to get all they were after, but did sign 59 contracts for $27 million worth of goods with Russia, Czechoslovakia, Hungary, Rumania and Poland.

Other agreements with Iron Curtain countries include $20 million worth of power-generating equipment from East Germany, and $40 million in oil drilling and extraction equipment from Rumania. A trade mission to Hungary concluded a $50-million barter deal under which Hungary sends machinery, railroad equipment, electric generators, cranes, high-voltage cables, transformers, and X-ray machines.

Many people believe Soviet trade will have relatively little future significance. Recently, Dr. Julio Cueto Rua, former Argentina Industry minister stated that important Russian technical and economic aid is unthinkable for the present, particularly because Russian oil equipment has failed to meet specifications.

The Soviets topped the field in Uruguayan trade during the first quarter of 1958. Business firms in Montevideo have gotten offers for Russian machinery and equipment at 50% of value, provided they invest the remaining 50% in advertising. Also Czechoslovakia offered to supply Uruguay's Usinas y Telefonos del Estado with telephone equipment that was priced 20% below the nearest bid.

How important Soviet trade here will become remains uncertain. The nationalist party that assumed power in March opposes it. And machinery specifications, now largely oriented to the US and Western Europe, are not fulfilled in Soviet products.

The pattern of exports and imports between Britain and Russia has remained fixed for some time. Copper wire accounts for nearly half of Russia's imports from Britain—$42.1 million in 1957 when purchases totaled $104 million. The USSR also imports small merchant and fishing vessels, textile machinery, and machine tools. From Russia, Britain imports raw ma-

Soviet Bloc Trade With Free World in Machinery & Transportation Equipment

	Exports		Imports	
	1956	1957	1956	1957
	(In millions of dollars)			
TOTAL MACHINERY & TRANSP. EQ.				
Soviet Bloc	$195	$242	$374	$470
USSR	21	40	222	221
Europ. Sat.	172	199	110	182
China	2	3	42	66
Non-Electric Machinery				
Soviet Bloc	97	138	156	260
USSR	4	19	62	98
Europ. Sat.	92	117	71	114
China	1	2	23	47
Power Generating Equipment				
Soviet Bloc	6	10	33	32
USSR	#	1	11	10
Europ. Sat.	5	9	18	21
China	#	#	#	#
Agricultural Machy & Implements				
Soviet Bloc	4	8	5	4
USSR	#	1	3	1
Europ. Sat.	3	6	1	2
China	#	#	#	#
Metalworking Machinery				
Soviet Bloc	26	31	12	25
USSR	#	1	5	9
Europ. Sat.	26	30	6	12
China	#	#	1	4
Textile Machinery				
Soviet Bloc	9	8	16	18
USSR	#	#	7	6
Europ. Sat.	9	7	4	8
China	#	#	5	3
Electrical Machy & Appliances				
Soviet Bloc	23	31	48	80
USSR	1	2	16	29
Europ. Sat.	21	28	25	41
China	1	1	7	10
Transportation Equipment				
Soviet Bloc	68	70	170	130
USSR	16	19	144	95
Europ. Sat.	52	51	14	28
China	#	#	12	7

Less than $500,000

Sub-categories are representative, hence will not add to total shown for machinery and transportation equipment
Source: US Dept. of Commerce

terials including wood, nonferrous metals and pig iron.

This pattern may change soon. British industry expects to send more machine tools and electronic goods to Russia now that the embargo has been relaxed. With the embargo changes of last August, Britain can send radio tubes, manufacturing equipment, spectrographs, spectrometers, electron microscopes, and X-ray diffraction equipment behind the Iron Curtain. These are all items in which the Soviets have expressed interest. Russia has already purchased some electronic equipment in Britain, including a mobile TV studio, direction-finding equipment, and oscilloscopes and voltmeters.

On the import ledger, trade experts in London look to Russian machine tools. "Their machines are of good quality now," one source says, "and I shouldn't be surprised to see Russian machine tools in British plants soon."

Trade between France and Russia is expected to reach 42 billion francs in 1959. Within the framework of a treaty, the French send semifinished and manufactured products to the Russians and get raw materials back.

Under the new agreement the Russians are getting an array of products—largely machine tools and industrial equipment. These include: 50 milling machines, 9 tube-drawing machines, seven 4000-hp gas turbines, 35 electric locomotives, 50 presses and molds for tire manufacturing, and other complete factory production equipment. The Russians will also get steel mill products, cables, radio and TV equipment and lab equipment. In the future the USSR is expected to shift emphasis from heavy industrial equipment to chemical plants.

France, for her part, will receive primarily coal and petroleum products. The Russians will also send some machine tools but these will account for only about 2% of the total.

Set Design Requirements for Aircraft Instruments, Systems

MONTREAL—Up-to-date airline requirements for new and improved instruments and systems for jet aircraft operations are being circulated to interested manufacturers by the Technical Department of the International Air Transport Association.

The requirements have been developed from discussions of turbine-powered transport operations at the Eleventh IATA Technical Conference at Monte Carlo last September. They supplement an earlier list which IATA distilled from the proceedings of the 1957 Technical Conference and circulated a year ago.

The new requirements, as listed by IATA Technical Director Stanislaw Krzyczkowski, are these:

Fuel filtration: Because turbine engines require cleaner fuel than that used in piston engines, improved filtration devices and continuous control of the fuel handling methods are necessary.

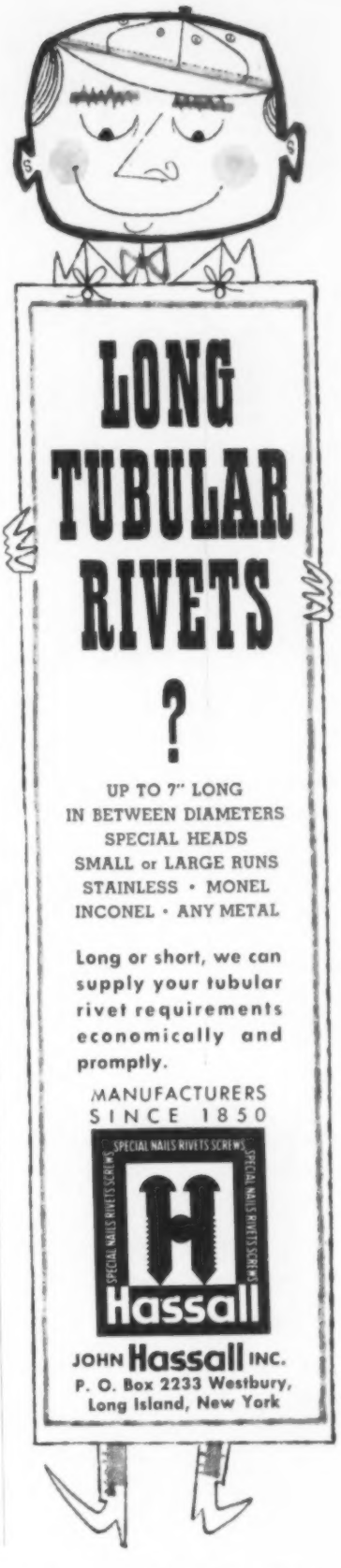
Fuel measurement: High fuel consumption of turbine engines requires more accurate knowledge of the amount of fuel aboard before take-off and of fuel consumed and remaining during the flight. Present aircraft fuel gauges and flowmeters are considered 5% short of complete accuracy. In a large jet aircraft, this can mean a payload penalty of 3,000 lbs or a range reduction of 150 miles. Airlines are prepared to go to great lengths to eliminate these penalties.

Altimeter static errors: Errors in the altimeters today at high altitudes have upped the vertical separation distance between aircraft from 1,000 and 2,000 ft, resulting in uneconomic use of airspace. New types of altimeters have been shown to be accurate in bench tests, but when installed in a plane did not function as accurately because of errors in the plane's static air system, particularly in high speed equipment.

Water injection: As a result of their experience with water injection in piston engines, the airlines are discouraging this technique in future engine designs, with the hope that the same improvement in performance can be found another way.

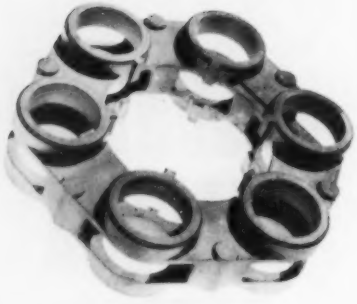
Engine quenching: More efficient coolants are needed to make this technique practicable. Research tests using water to reduce the internal temperature of engines and minimize fire hazards in a crash have been successful, but the weight of water which would be carried imposes too great a penalty. Chemical coolants have been suggested.

Vibration indicators and flight record-



CIRCLE 62 READER SERVICE CARD

Rx



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ers: A simple airborne vibration indicator is needed for airborne engine analysis, to aid day-to-day maintenance. There is also some interest in the use of flight recording equipment to economize on maintenance and overhaul procedures.

Artificial horizons: More reliable instruments to give accurate attitude information during all phases of flight and during take-off are needed.

Take-off monitor: The need for a simple and reliable indicator to monitor the take-off phase and to aid the pilot in deciding whether take-off should be continued or abandoned was stated by the 1957 Technical Conference. Considerable work is being done towards this end, and IATA is urging flight tests of the various new types of equipment offered, to guide further development.

Numerical Control Programs Now Written by Computer

"Engineers still haven't learned to use a computer; they're still digging trenches with their fingernails."—Gen. C. S. Irvine

CAMBRIDGE, MASS—An automatic machine tool control system, aimed at standardizing procedures throughout the aircraft and missile industry and drastically cutting the programming and lead time ordinarily required for any particular machining sequence, was unveiled here at the Massachusetts Institute of Technology. Called the APT system—Automatically Programmed Tool—it was developed at MIT's Servomechanisms Lab over the past two years on a contract with the Air Force Materiel Command. Nineteen Aircraft Industries Association (AIA) member plants on their own initiative have contributed for a continued development of the APT system. This is the first time that an effort of this scope has been mutually undertaken by a group of this size.

An indication of the breakthrough in programming complex part shapes using the APT system is shown by a typical wing rib shape which required 200 hours to program manually. With the new APT-Computer method the same task was cut to five hours.

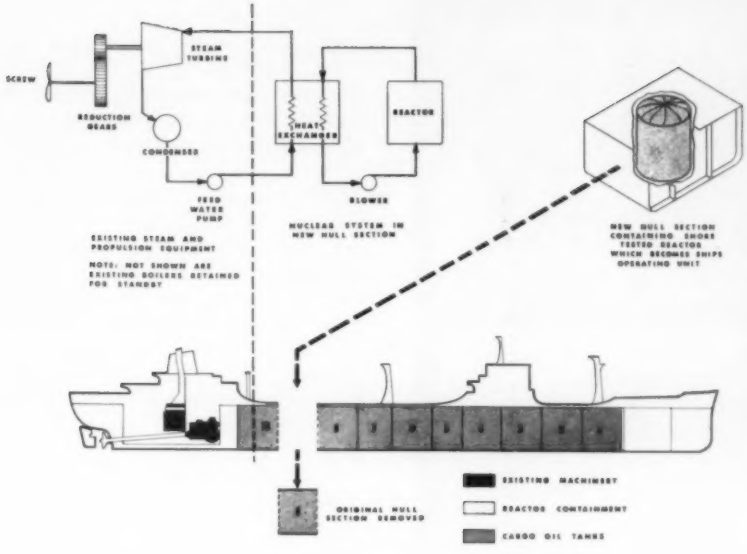
Key to the system is an English-like language which feeds part descriptions and machining sequences directly to a computer. The language permits a person with no knowledge of computers to control complex calculations, thus making use of the full potential of high-speed digital computers. Instructions are given to the computer on cards, where the necessary machining calculations are made and coded on the machine-tool control tape. A design change of a part is possible by a card change.

The first industry-wide testing of the APT system with AIA participating companies started last April. The field trial included 8,000 computer cards and 200 pages of preliminary data. The first programs were written for use on the IBM 704 computer because a survey showed that most of the companies had, or were about to get this type of computer. However, medium-sized computers and possibly even smaller ones can use the APT system.

The special computer language sounds something like this "ON KUL, ON SPN, GO RGT, TL LFT, CIRCLE CTR AT, +2, +3, RADIUS, +5." Translated, the directions mean: "Turn on the coolant, turn on the spindle, go right with the tool on the left side along the circle whose center is located at x equals 2, y equals 3, with a radius of 5." A little more than 100 other words, none containing more than six letters are the complete vocabulary of the system.

Although the APT system, in its present state of development, has not completely eliminated the need for manual programming, a year-long test by AIA companies, plus research at MIT has indicated that a significant portion of the parts now being manufactured can be produced using the present system.

Lt. Gen. Clarence Irvine, Air Force Deputy Chief of Staff for Materiel, one of the speakers at demonstration, lauded the development and said that Air Materiel Command expected the APT system to significantly reduce the important lead-time in developing new weapons systems.



Private Nuclear-powered Merchant Ship to Try New Design, Test Concept

NEW YORK—A special industry group, one of the first of its type, has been formed to carry out a program in the field of nuclear propulsion for merchant vessels. Also unique is the design of the gas-cooled reactor that will serve both as a prototype and the operating unit, cutting both cost and time.

The group is comprised of Ford Instrument Co., Div of Sperry Rand Corp., Maryland Shipbuilding and Drydock Co., and Isbrandtsen Company. The group hopes to bring about the first privately owned and operated atomic-powered merchant vessel. The group is seeking assistance from the Atomic Energy Commission and the Maritime Administration.

It is presently planned to test the reactor in a newly constructed cargo section of the vessel's hull at a remote location. After test operation, this hull section with its nuclear power plant will be substituted for an existing section of the ship. By this method the group will avoid the necessity of building a ship strictly for the purpose of proving out a reactor, and, for taking an existing ship out of service for a long period of time for the construction and prove-out of the reactor.

The reactor is helium-cooled, graphite-moderated, and fueled with stainless steel clad uranium dioxide pellets. Gas exit temperature is 950F. Superheated steam is generated at 640 psi and 850 F to power the 32,000 ton tanker launched last July.

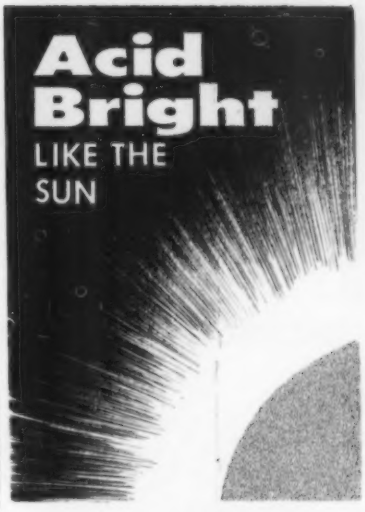
After conversion to nuclear power, the ship's boilers will remain intact to provide a standby system capable of full sea power.

The group's plan calls for the reactor system to be completed and ready for testing in just under three years, and ready for sea trials in 3½ years. Development cost will be $5 million; construction cost $10 million.

Germany Developing A-powered Ship

BONN—Interatom, the joint subsidiary of Atomics International and the German company Demag, and the Hamburg Association for Nuclear Energy Utilization in shipbuilding and shipping have signed an agreement to build jointly a commercial ship powered by an organic moderated reactor.

An OMR reactor was selected because of its comparatively low weight and because the cooling agent becomes radioactive only to a very small degree, facilitating service and repair work of the primary circuit while the reactor is in operation. Additionally the low pressures of primary and secondary circuit allow the use of normal steel and aluminum without excessive wall thickness thus keeping investment costs down.



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Prune Your R & D, Experts Tell AMA

CHICAGO—Don't forget the individual and his ideas when striving to get the utmost out of the company research program, a top chemical company executive warned a recent American Management Assn conference on planning, producing and promoting new products here.

"I know of no committee, no team, no company that ever came up with one idea," said R. H. Boundy, vice president and director of research, Dow Chemical Co., Midland, Mich. The time for the team approach comes after the idea's conception, in implementing and developing it, he said.

While doing everything possible to encourage stimulation of ideas and freedom at the idea stage, it is necessary to be increasingly selective about dollars spent, after technical feasibility has been proven, Boundy said. He cited a 100% increase in the cost of keeping a man on the job in research since 1946. This means, that greater efficiency is needed to keep pace with rising costs, and to measure the effectiveness of a company's research.

HOW COMPANY EVALUATES EFFECTIVENESS

- **Install a sound accounting system which will provide an immediate breakdown at all stages of projects—either in hours or dollars expended.**
- **Take a critical look at the morale of the research group every year—reasons for personnel turnover.**
- **Check the number of patent applications, disclosures and patents issued.**
- **Read scientific, technical publications; encourage writing articles.**
- **Check pilot plants, to see how many are shut down, reasons for failure, etc.**
- **Study the new products.**
- **Look at the amount of new capital invested as a result of research.**
- **Determine the tangible value of process and product-improvement research.**
- **Investigate the value of new applications for existing products.**

Boundy said he believes the age level of the research organization should be kept relatively low. In the case of Dow, a turnover of about 10% enables the company to keep the average age between 32 and 35. "Research is a young man's business." Also, researchers should be given sufficient space to maintain several proj-

cets simultaneously. The right problem to work on has to be determined, and data-taking should be automated to the greatest extent possible in order to cut down pilot-plant work, Boundy said. Still another way of contributing to profitability: sell the research which the company cannot use.

In a talk on the fundamental factors in calculating costs of potential new products, George J. Wachholz, controller for Minnesota Mining & Mfg. Co, said the "proper blending of the optimism that we do and should find in the research group, and the practicality or realism of the financial group, should lead us to objective evaluations in most cases."

CHECK COST EARLY

While 3-M has no formula for determining whether a specific research program should be continued or terminated, it does begin analyzing costs in the early stages to try to decide which projects have little commercial potential, and which should be pushed hardest, Wachholz said. As technical aspects progress, cost estimates become more meaningful. These cost estimates are prepared by the controller's division on the basis of known experience and existing facilities, and help the research people put their work into a framework. If objectively used, unit cost estimates can avert the development of a technically perfect product which cannot be profitably marketed.

Researchers must be encouraged to think broadly; Example: 3-M is seeking non-nuclear uses for materials for future nuclear application.

Wachholz said that 3-M calculates the cost of product research by applying wage overhead rates to each project. Fifteen percent of laboratory effort is arbitrarily allotted to "blue-sky" researching. Wachholz said. While operating divisions conduct their own research, the central research lab accounts for about 25% of 3-M's overall research effort. Total R & D cost at 3-M currently is about 4 to 5% of sales, with R & D costs at the operation division level running at about 1½ to 6% of total cost. R & D forecasts generally cover one year, but periodically are projected five years ahead.

"The attitude on the part of the controller's group must be one of aiding and abetting the research men to identify problem areas and find solu-

(Continued on page 32)

FASTER

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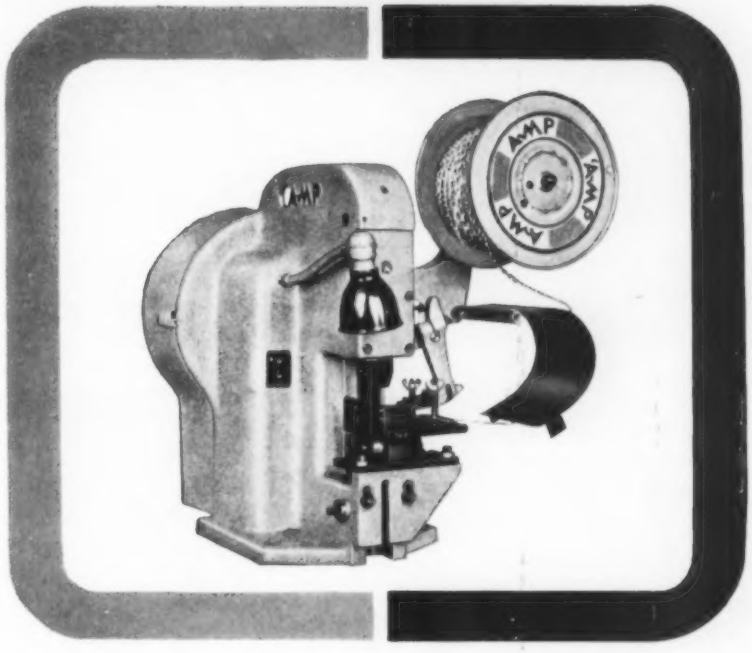

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CIRCLE 67 READER SERVICE CARD

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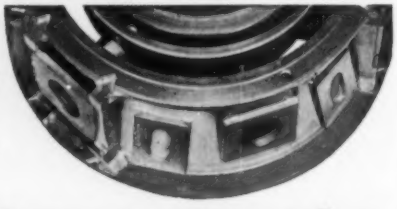

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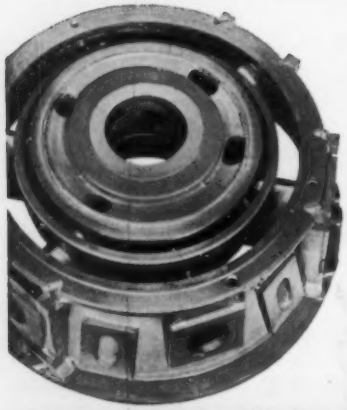

This jet engine diffuser casing is typical of the aircraft and missile parts being furnace brazed at Wall Colmonoy. As originators of Nicrobraz Process brazing, we have an unmatched background in the nickel-alloy brazing of stainless steel and superalloys. Our facilities also include vacuum furnaces for degassing and brazing titanium bearing alloys. Our three plants are ready and able to engineer and process your components. Call or write today.

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tions to those problems, rather than to assume a critical attitude or to place limitations on the research organization," Wachholz said.

J. O. Reinecke, Reinecke Associates, Chicago, industrial designers, stressed the need for a product-planning group that would feature: (1) Participation by top management, including vice presidents of sales and engineering. Their staffs, industrial design consultants and a cost engineer; (2) scheduled meetings; (3) frequent meetings; (4) a complete agenda.

"I believe there is too much 'group thinking' today, that there are too many committees, that individual responsibility is being diluted. But somehow this group, in spite of its size, accomplishes much," he said.

You Decide

ITHACA—Class standing, not just possession of a diploma, is what counts with industry considering the engineering student for employment, reports Donald H. Mayer, Cornell Univ-Engineering College director of Student Personnel. The cry is not so much for more, but for better engineers, he said.

According to Mayer, engineer students graduating in the top half of their class will have no placement problems but those in the bottom half may not get the job they want at the salary they want in the geographical location they want.

His remarks would seem to offset reports of an engineering shortage, but . . .

SCHENECTADY—The shortage of professional engineers is one of the most serious problems confronting the nation today, reports Rear Adm. W. D. Leggett, Jr., v-p, ALCO Products, Inc. in a speech to engineering students.

Pointing up engineer employment significance to national employment, Adm. Leggett said that in 1930 there were 261,000 scientists and engineers out of a 48.6 million total work force or a ratio of 180:1. By 1956 the US work force had grown to 68.8 million and there were 950,000 engineers, a ratio of 73:1 or an increase of 2½ times that of 25 years before. This illustrates the growing need of engineers to keep this labor force gainfully employed.

Leggett said a 13% drop in the number of American students taking up engineering in colleges and universities indicates an even more serious shortage in the future.

Silicone rubber wire insulation withstands soldering heat without damage

Thanks to silicone rubber's remarkable heat resistance, no damage occurs when you lay a hot soldering iron on silicone-rubber-insulated wire. And silicone insulation strips cleanly and easily, saving hours of assembly time in the plant. Right-angle bends are no problem. Colors are bright for easy identification.

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HERCULES

Plastics Hi-lites

The hoops have had it ...now what?

Tremendous markets for new polyolefin plastics seen on all fronts

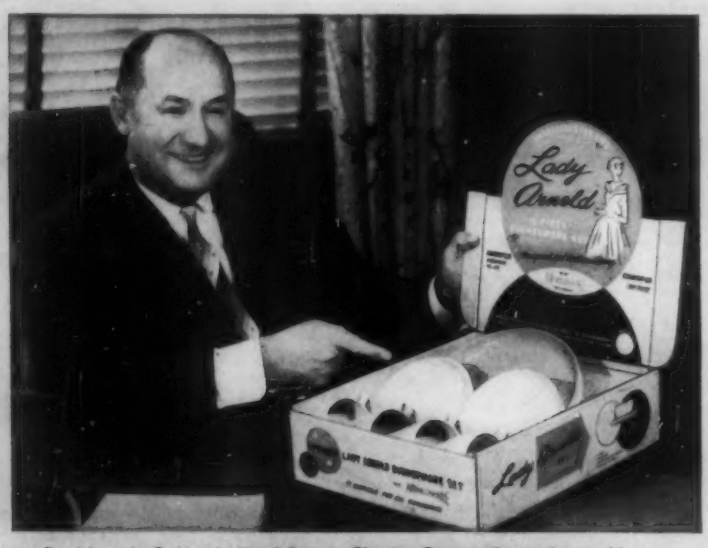
A new plastic—*high-density polyethylene*—was responsible for the hula hoop, undoubtedly the biggest product success story of 1958. There's no similar market windfall in sight for the coming year, but most manufacturers see this same plastic, and a still newer member of the polyolefin family—*polypropylene*—as their best bets for building increased consumer sales in '59.

Housewares, appliances, sporting goods and toys are among the many fields where product planners are now finding ways to whet customer buying appetites with these new plastics. Polypropylene made its bow at the January housewares show in Pro-fax® cutlery handles and dinnerware (*see below*). At the same time Cory Corporation made the first use of Pro-fax in a commercial coffee service.

While the hoops got much of the publicity about high-density polyethylene last year, this material made its most significant long-term gain in another direction. Development of the first thin-wall, non-functional Hi-fax bottle opened up a giant new market for plastics in carrier-type bottles. First employed as a container for Breck Banish, the new Hi-fax bottles were quickly adopted by users of other drug and cosmetic products. Several producers now offer a line of stock Hi-fax bottles in a variety of shapes and sizes.

Meanwhile some of the nation's leading "Soapers" have been market-testing liquid detergents in Hi-fax bottles, with such excellent results to date that a switchover to this new type package may be imminent. The big advantage of Hi-fax in this use, in addition to its ease of fabrication, is its outstanding resistance to stress-cracking.

All three members of the Big Three are sporting either Hi-fax or Pro-fax parts on 1959 cars. The many other applications under evaluation point to an increased use of both these plastics with the model change due next fall.



President A. C. Martinelli of Rogers Plastics Corporation points to his new Lady Arnold dinnerware line for which he selected Hercules Pro-fax.

PUTTING THE WEAR IN PLASTICS DINNERWARE . . . Pro-fax does it in the new Lady Arnold line to the extent that its manufacturer, Rogers Plastics, guarantees these dishes for life against chipping, cracking, and staining. Combining the beauty and elegance of expensive china with the low-cost durability of a tough thermoplastic, this new dinnerware is completely dishwasher proof, and molded in four lustrous pastel colors with a rich permanent gloss.

Hot tip for coffeemakers

A new pouring lip for Cory serving decanters, molded with Pro-fax, polypropylene plastic, looks better, lasts longer and costs less than conventional metal spouts. Cory Super-Tuf* pouring

BETTER IDEAS FOR BETTER COFFEE ALWAYS COME FROM CORY . . . that's the company's motto and to prove its point Cory uses Pro-fax for a new type pouring spout unharmed by detergents and defying abuse.

lips will take all kinds of abuse . . . won't dent, crack or stain from hot beverages or harsh detergents. Molded with black Pro-fax, they have a rich, glossy finish that is unharmed by high temperatures or hard use.

Designed to combine with Cory's Majestic* glass serving decanter for the utmost in a modern, smartly styled coffee service, the new spouts can also be employed as replacement parts with current model Cory handles and neckbands.

**Registered trademark of Cory Corporation, Chicago, Ill.*

No trouble with Pro-fax

The manufacturer of this durable and attractive trouble lamp tried other plastics in the handle, but only Pro-fax proved up to the job. Equipped with U.L. approved cords, ranging in length from 20 to 50 feet in red, green, or black, with matching Pro-fax handles, this new trouble light features a push-button switch, convenience outlet, and cord strain relief, is oil, grease, acid, and alkali resistant. Pro-fax handles are molded by Precision Plastics Company, Philadelphia, Pa., for M. Black Manufacturing of the same city.

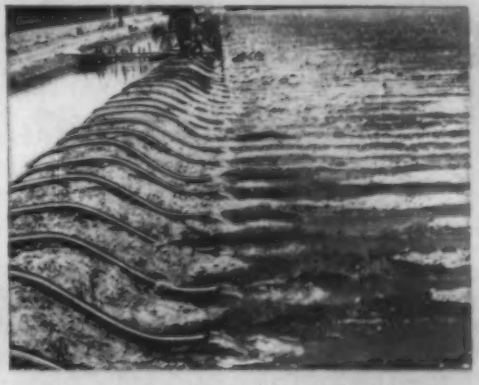
Market Hi-lites

A new cup produced by Crown Plastics Cup Company, Fort Worth, Texas, demonstrates the excellent moldability of Pro-fax in thin-wall sections. With a six-ounce capacity, the cups weigh less than a third of an ounce each, yet are unbreakable and can be sterilized. Among their first uses was in hospitals where with re-use after sterilization they have proved actually cheaper than the paper disposables formerly employed . . . Another new Pro-fax hospital item is a plastic bedside carafe and tumbler set manufactured by Zylon Products Company, Pawtucket, R. I. Completely autoclavable and fitted with a disposable plastic-film liner, this well-designed new product promises to revolutionize the entire technique of bedside water service. The first use of Pro-fax in an aerosol type package will be announced by one of the nation's leading cosmetic manufacturers within the next few weeks.

A 7½-inch Pro-fax rope has just replaced a 10-inch manila hawser on the Sinclair supertanker, S.S. J. E. Dyer. A product of American Manufacturing Company, the new plastic rope actually has greater breaking strength than its larger manila counterpart.

Good dam use for Hi-fax

Literally miles of Hi-fax tubing are being used here to siphon water over the high banks of a dammed-up ditch,



in the pre-irrigation of a cotton field. Hi-fax siphon tubes are becoming standard equipment throughout the irrigated West and South, eliminating the labor involved in cutting through ditch banks, providing better control of flow and reducing soil erosion. The Swanson Company of Phoenix, Arizona, first to produce the new Hi-fax tubes, promotes them as "tougher, lighter, with greater resistance to high and low temperatures and higher tensile strength." They are now marketed in lengths from 48" to 90" in both 1" and 2" Hi-fax tubing extruded by Arizona Plastics Extrusion Company, Phoenix, Arizona.

CP59-2

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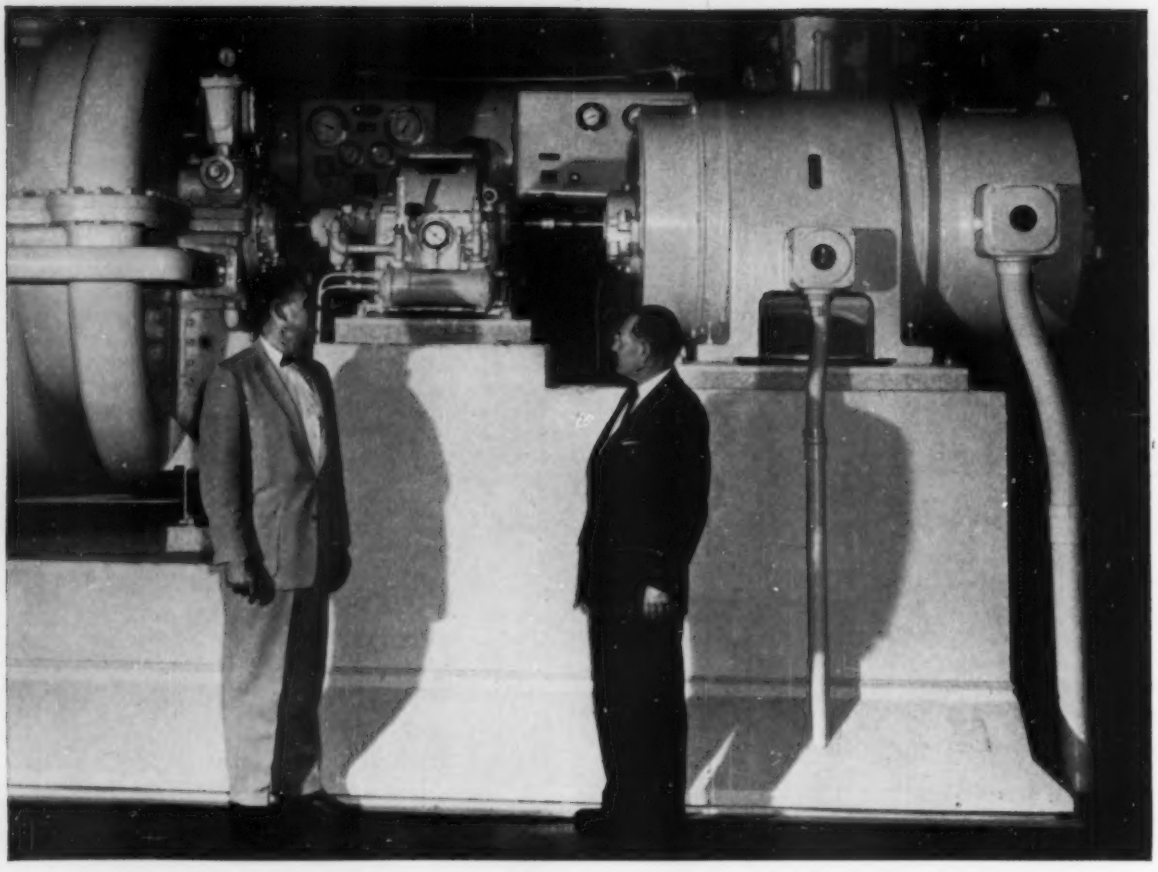

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WELCOME—INVENTORS

How a new kind of company turns raw patents into money-making products

JACK MEYER *Staff Editor—Los Angeles*

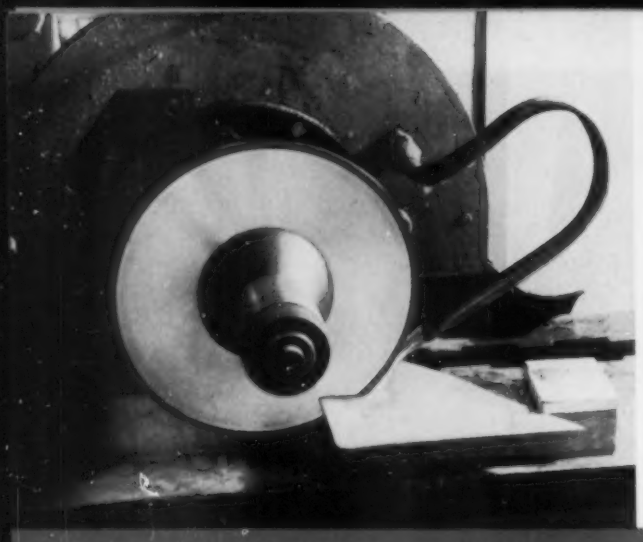
■ "I've got a million dollars here and I don't know how to get at it!" This "inventor's lament" was voiced by Chet Sweet, gas-station operator and spare-time inventor. He carefully placed a 3-inch disk on the conference table of Bill Beach, Manager of Licensing and Research for Navan Products Inc, a company whose mission is to create bridges between inventors and their dreams of glory.

"Interesting, but what is it?" On learning that "it" was a diamond-edged cutting wheel, Beach asked the question that invariably precedes any business discussion with an inventor.

"Have you taken adequate legal steps to protect this invention?" Knowing it's not uncommon for an inventor to be in imminent danger of losing all rights through an ignorance of patent law, Navan does not hesitate to tell the unprotected inventor where to go—straight to a patent attorney.

Minimum prerequisite to a discussion is a "poor man's patent." This sealed, registered, self-addressed letter describing the invention affords protection only to the extent of establishing its date. When the inventor has taken any necessary legal steps, Navan explains what the business arrangements will be if the invention is accepted for company promotion.

***Evaluation committee** decides whether Navan is interested in these inventions and to what extent. From left, Larry Weddell, Jim Marshall, Bill Beach and Jim McIraith examine the Sanders constant-temperature fan. On the table you see (front row) an improved vane-type pump, a rivet trimmer, a hydraulic quick-disconnect and many more.*



WELCOME—INVENTORS

(Continued)

***The Diatronic diamond wheel** cuts tungsten carbide on a Do-All Microtomatic machine.*

Typical arrangements may be:

- **The company acts only as a marketing agent for the product. The inventor makes his profit as manufacturer, the company makes a percentage of the selling price.**
- **The company acts as manufacturer and sales agent. It will make the device under its name for sale through its organization. The inventor gets a royalty.**
- **The company licenses manufacture and distribution to an outside manufacturer. Royalty is split with the inventor.**
- **The company acts as the inventor's agent in selling the invention outright. It collects a percentage of the proceeds for this service.**

The inventor may decide to drop the discussion at this point, if he doesn't like the terms.

Ten years earlier Sweet had read of the problems encountered in using diamond-edged wheels. He borrowed books, read articles, experimented and finally perfected a thin cutting wheel with closer width tolerances than anything on the market.

The cutting wheel was taken before Navan's Evaluation Committee, which recommended a preliminary market investigation. Larry Weddell (who has spent over 20 years in customer-contact work) made a quick tour of transistor manufacturers in the Los Angeles area. Wherever he called, he found top production managers willing to drop whatever they were doing to talk to anybody who could offer a better cutting wheel. Larry recommended that Navan start test-marketing the product as soon as possible.

The Diatronic wheel reversed the 60%-scrap-to-40%-product ratio that had troubled manufacturers using highly-purified silicon and germanium costing up to $5000 per pound. Recently, the Do-All Company signed an agreement to distribute the wheel here and abroad.

As with many other products, Navan now keeps a careful eye on users of the Diatronic wheel, makes sure that technical servicing is available whenever problems are encountered, and supplies literature and sales promotional effort.

What's Navan?

North American Aviation originally set up Navan to market, if possible, patents held by employes and the company. Later, the group was made a separate entity to handle not only the patents developed by North American and its subsidiaries, but also outside inventions. There was a profit to be made by an organization that could establish contact between inventor, manufacturer and purchaser.

A "feedback benefit" from the program has been to make available to the parent company—on a low-cost, quantity-production, off-the-shelf basis—items whose unit costs had previously been quite high because of limited manufacture.

The new company has marketed products in industry remote from any North American line of endeavor—products created on the spur of the moment to solve immediate, highly-specific problems. For example, a man assembling crates for aircraft parts one day hit the nail right on his thumb. This inspired him to suggest to packaging engineer Wiley that it should be possible to develop a fastener whose strength and reliability would be equal to or better than that of crating nails and which could be installed with a lower order of marksmanship.

Wiley considered the problem, came up with a C-shaped piece of tempered spring-steel wire soon dubbed "Klimp." This device, to replace nails for holding the walls of a packing case together, is installed with a single vigorous whack of a broad-headed hammer.

H. H. Lamar, at that time chief packaging engineer for North American, saw the possibility of designing a complete modular packing system around the Klimp. Panel sizes are standardized and since the fastener does not harm the box when used, both panels and fasteners are indefinitely reusable. Assembly time is about two-thirds that for nailed boxes; and the cost of preparing modular panels for reshipment is less than the cost of destroying nailed boxes.

Another recent product, the Navent seal, required extensive market studies in brand-new areas. This small, mushroom-shaped seal was designed at the Rocketdyne Division for use on pressure valves. Made by Kel-F, it permits venting of internal pressures, seals out external contaminants. In the test-marketing program, intended to determine market potential rather than immediate sales, engineers spoke to valve manufacturers, chemical companies, petroleum companies, refrigerator manufacturers and automobile manufacturers. In each case, the purpose was to find uses for the product on an "as is" basis, and also to uncover additional needs that could be met by reasonable design changes.

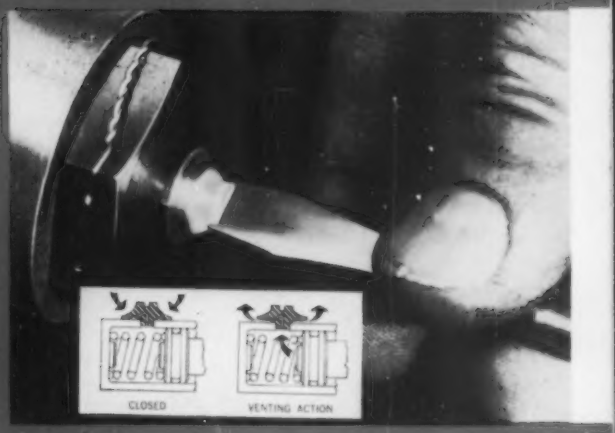
Specialized Marketing

Sale of inventions and patent licensing requires a highly specialized form of market research, plus wide experience. This helps the evaluation committee judge the validity of an inventor's claims as to the markets and uses for his invention. The alternatives are: Have the product manufactured for sale through their own organization, attempt to license it, conduct a more detailed market study, or decline with thanks.

Navan does not like to deal with reluctant inventors; drops the discussion if there seems to be too many doubts as to the fairness of the proposal. "We can't afford to deal with

***The Klimp** fastener is snapped out with a specially designed hammer. A selection of standardized panels offers a wide variety of packing crate sizes.*

***This tiny plastic seal** is used in vent holes in rocket engine components. It will release internal pressures without permitting contaminant entry.*



a man who doesn't trust us. If he's unhappy later, his complaints can do more harm to the reputation we have established for protecting the inventor's rights than the product is worth."

The detailed market survey determines the product potential, the best channels for distribution, and the best methods for contacting the market. It may indicate that the product could best be distributed by a company making a related but noncompetitive product, which would favor a licensing arrangement; or that a successful sales program could be accomplished through a relatively small number of individual contracts—which would favor sales by Navan. With a licensing arrangement, Navan attempts to negotiate a deal that will not discourage production with too high a royalty, but will insure an adequate return. Licensee sets his own price on the product, but Navan attempts to see that this is established at a level that will insure the most profitable exploitation of the patent and retains the right to revoke a license or to issue additional licenses.

Now it can be sold . . .

A comprehensive file is maintained, listing names, interests and facilities of most manufacturers who have contacted Navan and expressed an interest in obtaining licenses. These range in size from small job shops to nationwide multiplant operations. Once Navan agrees to market an invention, this list is checked for potential manufacturers.

If a company turns down the chance to make a product, Navan tries to get them to state the reason. This information may be helpful to other companies contacted—or it may even indicate the prior existence of a superior product.

As soon as the manufacturer can turn out a pilot run, Navan starts what it regards as real market research—a test program of sales and sales promotion based on the principle that the exchange of products for money is the most reliable index of marketability. Promotion costs are usually low—many products have been given national sales exposure for a few hundred dollars—but they make it possible to determine whether selling is going to be hard or easy and how much of a sales investment is needed. Also, getting a product into the field gives valuable data as to its operation in the hands of users—not always in agreement with the conclusions reached in lab tests. Direct-mailed data cards with promptly handled inquiries has proven one of the most effective tools in market-probing and reaction-generating.

This marketing operation is carried out for products to be sold through Navan and also for those whose distribution is to be handled by licensees. In the latter case, it provides a "kick-off" to spur the manufacturer on to more vigorous exploitation.

In Navan's initial contact with a potential licensee, all available information concerning the invention is disclosed—description, drawings, patent status, photos and prototype if available, plus the results of whatever market study has been made. Nothing is held back which will assist the potential licensee in his own evaluation of manufacturing and market problems.

In normal cases, an advance royalty is required. This encourages the potential licensee to take a long, hard look at the invention before committing himself. It also means he's going to make a vigorous effort to recover his royalty as soon as possible. In a case where the licensee has a number of other interests, this extra impetus may be just what it takes for the new product to be firmly established as a part of his line.

Advantages of full exploitation

Pat Bales, general manager of Navan, states that the ingredients needed for any profitable business are: a product, adequate financing, foresight, self confidence, and the ability to establish a long-range sales program.

Navan's conviction that its organization fills a long-felt need is strengthened by several recent developments. Last July, the organization was doubled in size; in justification, sales tripled by October. Longer range sales programs are in the works, including some scheduled to operate in the red for more than a year in order to realize a good profit within three. With half of the products now being marketed having resulted from "outside" inventions, they can see no end to the steady supply of models, drawings and patent applications only awaiting alert evaluation and effective exploitations. ■

How to Select and Apply

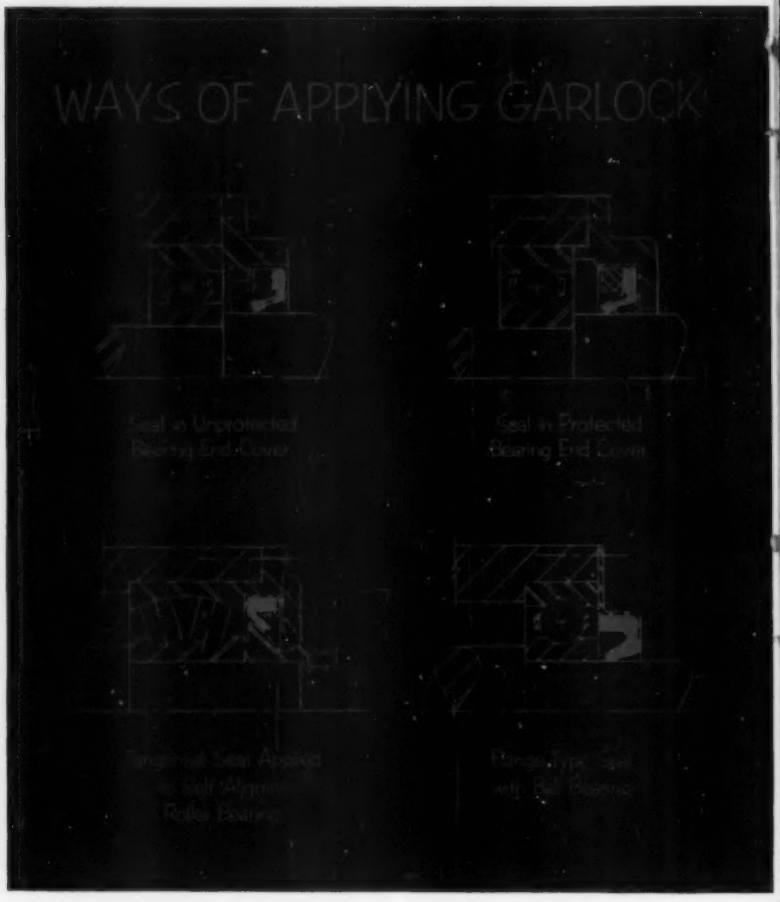
Selecting a Seal

Any ball or roller bearing seal must do two things: (1) It must keep lubricants in; and (2) It must keep dirt and grit out.

Factors to consider when selecting a seal are whether the shaft operates at high or low speed, whether the bearing load is heavy or light and whether the operating temperatures are high or normal. Also remember that the sealing of oil requires a more efficient seal than the retention of grease.

Seal Types

There are, of course, many kinds of seals used to protect bearings to some degree. Unit or lip type seals, such as the Garlock Klozure* Oil Seals illustrated, provide the best protection for automobiles, tractors and industrial machinery.



A

shows a Garlock Springless Klozure Oil Seal used where heavy lubricants are to be contained and dirt excluded.

B

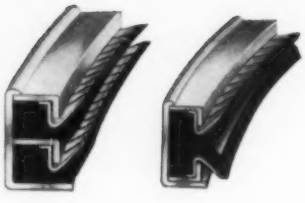
shows a Klozure with finger spring, very efficient for normal and high speed oil sealing on all size shafts.

C

shows a lip type Klozure with garter spring for sealing oil at normal and high speeds on shafts from 1" to 10".

D

shows a Klozure oil seal with combination finger and garter spring for use on large shafts operating under severe conditions.

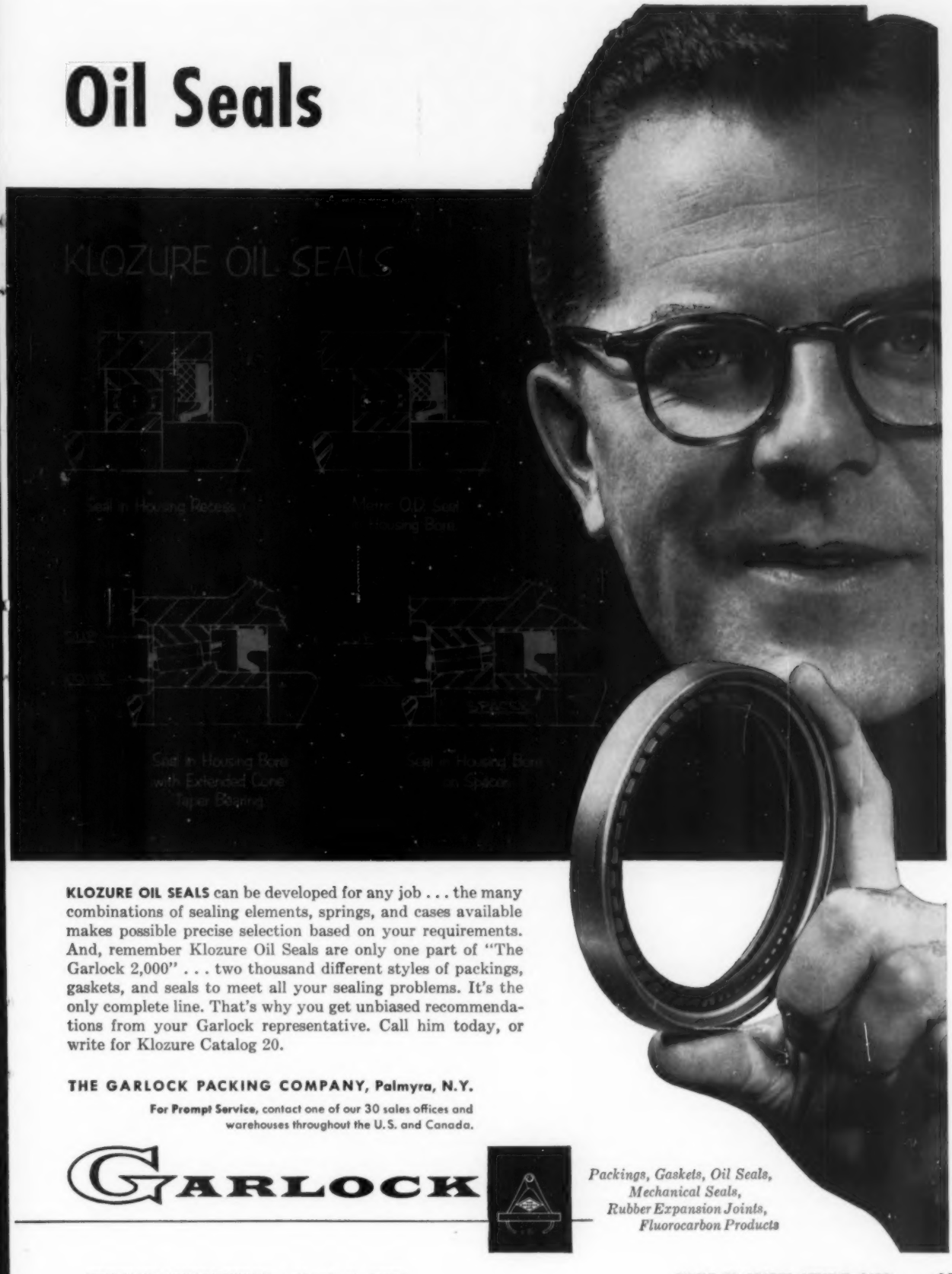


E **F**

Klozure Oil Seals are also available in dual tandem (E) or dual opposed (F) constructions for unusual sealing problems caused by operational or environmental conditions.

*Registered Trademark

Oil Seals



KLOZURE OIL SEALS can be developed for any job . . . the many combinations of sealing elements, springs, and cases available makes possible precise selection based on your requirements. And, remember Klozure Oil Seals are only one part of "The Garlock 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet all your sealing problems. It's the only complete line. That's why you get unbiased recommendations from your Garlock representative. Call him today, or write for Klozure Catalog 20.

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For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints, Fluorocarbon Products

the ECONOMICS of RESEACH and NEW PRODUCT PLANNING

You can take some of the gamble out of R & D bets with a bit of realistic market analysis and a careful budget estimate.

RUSS EGGERS *McGraw-Hill Economics Dept.**

■ The American Alcolac Company of Baltimore has a simple, but effective, formula for rating the profitability of an R & D project:

Chance of technical success
× Chance of commercial success
× Annual volume × (Price–Cost)
× Product life ÷ Total costs = Project number

This is a ratio of the *total expected profit over the life of a product* to its *total development cost*. The formula provides no radically new information, but it forces you to take an objective look at the project.

Suppose the chances of coming up with a better mousetrap are estimated at 80%. The sales manager guesses a 60% chance of commercial success. If you can make it for 13 cents he says he can sell 500,000 traps per year at 18 cents each to the retailers over an 8-year period; then something new will come along. Estimated research costs are $20,000; market development, $40,000; engineering and production design $40,000—total costs: $100,000.

$$\frac{0.8 \times 0.6 \times 500{,}000 \times (\$0.18 - \$0.13) \times 8}{100{,}000} = \frac{96{,}000}{100{,}000} = 0.96$$

This project is a honey. They'll lose $4000 for their trouble! But if they could cut the research cost to $10,000, market development to $20,000, engineering and production design to $20,000; the total cost becomes $50,000 and the ratio 96,000/50,000 = 1.92 is a very different story.

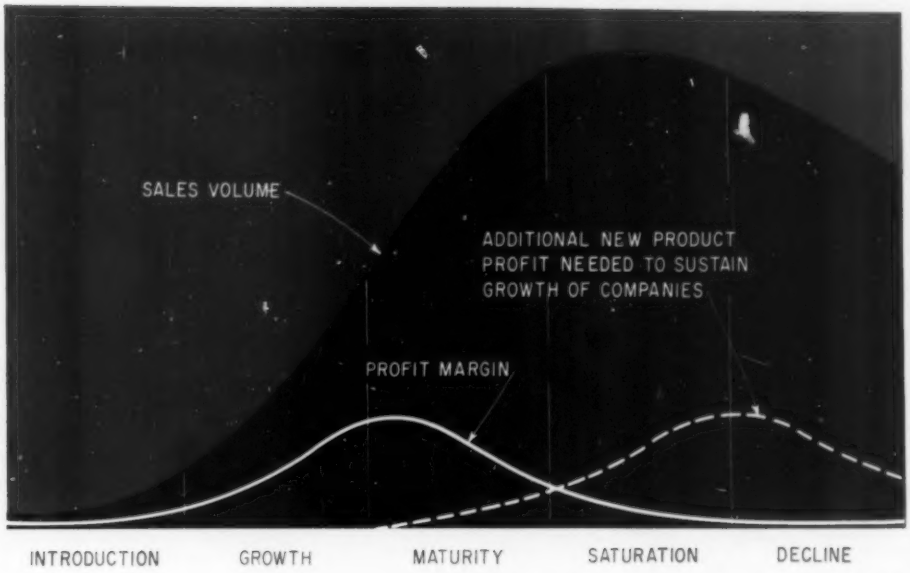
A similar method is used at Armour Research where a paying research program must be established for their customer-companies. The Engineering Economics Research Dept uses a three-step process: designating the alternative courses of action; estimating the outcome from each alternative course; estimating the probability of success.

They evaluate each alternative in terms of: cost of research; time of research; probability of technical success; effect of volume; probability of commercial success; exploitation investment; time span of profitability; profitability; rate of return on investment. With these estimates the company executive committee can evaluate various programs on a comparable basis and one, or more than one, program may be actively pursued. Note that re-evaluation at semiannual or annual intervals is also possible and desirable.

Evaluating a project and plugging numbers into a formula looks easy, but the estimates, if they're to be worth using, will take some careful thinking and inspired guesswork. According to one survey, even the more successful of the research-minded companies find that fewer than 50% of their carefully thought-out new products show a profit. And the failures aren't owing to a lack of good ideas or technical success.

Despite these risks, research for new products is still very profitable. But the profit curve on a new product—unlike that of conventional products—is often reversed. Instead of building up your market over a long period, getting costs down, knocking out your competitors—you take a quick profit on the new product and then start worrying (see chart). This short-lived but lucrative monopoly that

* Now with the Chase Manhattan Bank



In this age of innovation a company needs a continuing flow of new products to sustain profit margins. The early monopoly pays off handsomely. Late arrivals are just in time to be caught in the profit decline. Sources: Booz, Allen & Hamilton

goes with a successful new product is important—for it often gives the small adventurous company a chance to beat the big boys. Large corporations tend to move slowly, testing the market, probing—before making any large scale commitments of capital.

So, new products are risky, profitable and anybody can play at the game. How does a company judge the profitability of a new product in advance? Two rule-of-thumb methods were given above; now let's take a look at W R Grace & Co.'s Polymer Chemicals Division to see a check list in depth.

Grace puts a big emphasis on the early screening of new product ideas, since this is the source of a company's most expensive mistakes. In order to get a profile on each new product up for consideration, Grace takes a close look—and classifies simply as VERY GOOD, GOOD, AVERAGE, POOR or VERY POOR—for the following:

The stability factors: How durable is the market for the new product? Is it steady, like the market for sulphuric acid; a slowly declining one such as textiles; a Hula-hoop market? Is the product one which can be used nationwide and abroad? Is it easy for other manufacturers to copy? Have you a captive market for the product within the company? How would its market hold up in a depression? Would wartime shortages of critical materials give you trouble?

The growth factors: Is the product (or process) really a unique one? Will demand for the product grow? Can the product ride a big new technological change that is coming up, or will new technology probably make it obsolete? Do export possibilities add to its growth prospects?

Marketability: Can you sell the product through your present sales setup? If it's in a new field, will your present reputation help any? How well has competition been handling this market? Will you sell the product in large volumes to a few customers? How many variations or styles in the product will be required? Is it free from seasonal fluctuations or can you sell it all year round?

About your company's position: Are you well established in the field so that you can commercialize the new product quickly? Do you have any special advantages in purchasing materials? Do you supply your own raw materials? If not, will the new product put your purchase of raw materials into the carload or tank car class, so you get a break on costs?

The research and development factors: Can you develop the new product idea with your current knowledge? If not, will the product give you information you can use or take you down a side street? Would it utilize existing laboratory or pilot plant equipment? Can you get enough R & D personnel to handle the additional work?

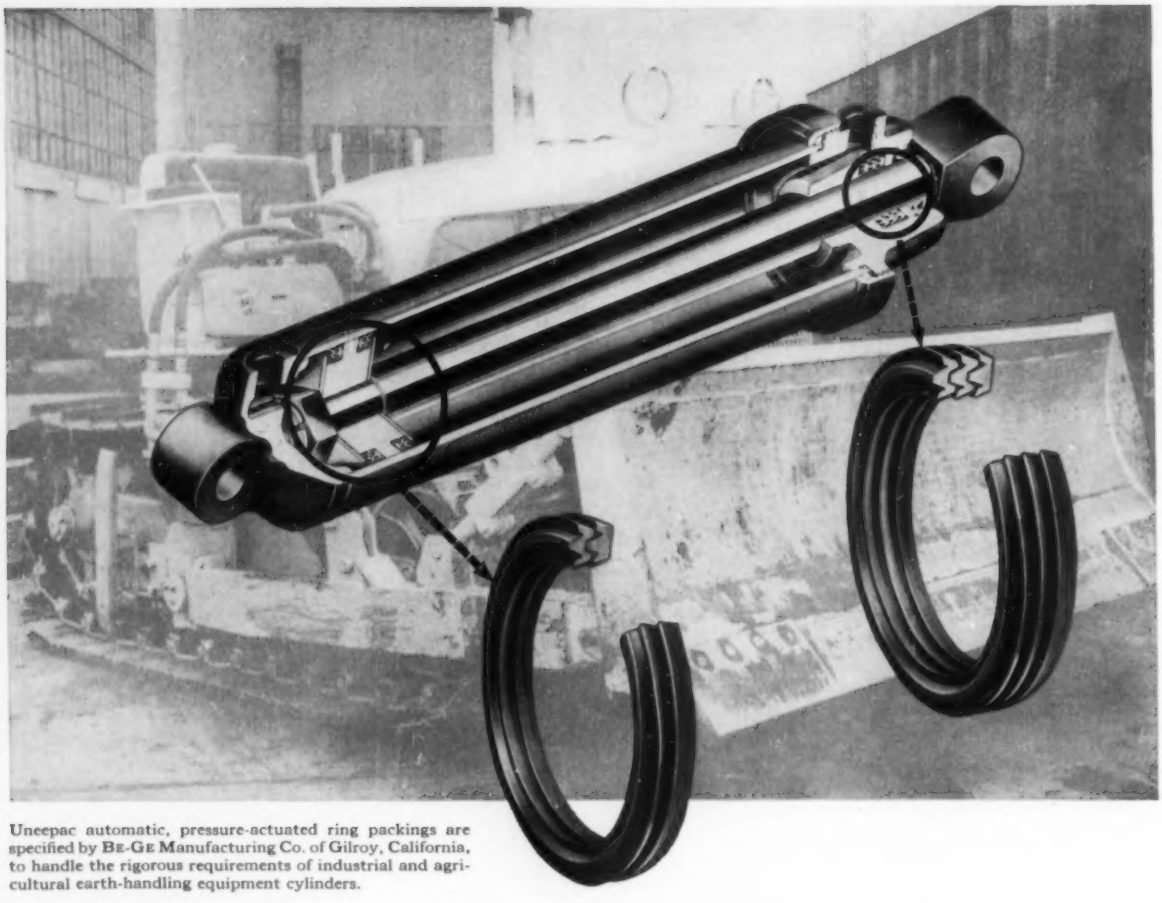
The engineering factors: Do you have all the process know-how or are there unknowns which may add to the costs? Will you use a high proportion of standardized equipment to produce the product? Will it overload your engineering staff?

The production factors: Will the new product put idle capacity to work? Does it use familiar production techniques? Will it require substantial investment for new utilities—power, water, gas? Is it free from hazards, difficult maintenance problems, waste disposal headaches?

These are among the 39 specific questions which Grace uses in its economic thinking about a new product. Viewed in so comprehensive a way, you find out quickly whether the product is at all promising for your company. Profiles of different suggestions can be evaluated, compared and screened.

Nobody, of course, has been able to come up with *the* magic formula for predicting the profitability of a new product, but one thing is certain: the more objective the analysis, the more likely the profit. ■

Rigorous tests convinced BE-GE to use J-M Uneepac® in their rugged cylinders



Uneepac automatic, pressure-actuated ring packings are specified by BE-GE Manufacturing Co. of Gilroy, California, to handle the rigorous requirements of industrial and agricultural earth-handling equipment cylinders.

Uneepac proves it can handle shock pressures to 4,000 psi in three-year, life-test program

• BE-GE Manufacturing Company's line of cylinders for their hydraulic systems has to stand up to years of day-in, day-out abuse. That's why BE-GE engineers subjected J-M Uneepac Rod Packings to a 350,000-cycle test and Uneepac Piston Packings to a 150,000-cycle test in a three-year program that proved Uneepac can take working pressures to 2,500 psi—shock pressures to 4,000 psi. As proof of performance, Uneepac is now the specification packing on all BE-GE standard—and heavy-duty cylinders.

Pressure-actuated Uneepac Rings offer high-efficiency sealing in minimum packing depth. Each ring provides an efficient, individual seal—nests with adjacent rings in an interlocking manner without compression adjustment for true, multiple-ring action.

With Uneepac, you can achieve high-efficiency sealing with fewer rings, smaller stuffing boxes. For quick, easy installation, Uneepac rings are self-centering, self-adjusting. Make it a point to consider Uneepac Rings for every application requiring top packing efficiency and life.

Uneepac rings are available in all standard materials in a wide range of sizes for most rod and plunger applications. For further information, write to Johns-Manville, Box 14, New York 16, N. Y.

J-M Clipper Seals—used as rod wipers in BE-GE cylinders—keep dirt out.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

THE ENGINEERING EDUCATION DEBATE . . .

Has Capitalism Failed?

Without corrective measures now, our methods of engineering education may not be adequate to compete with the efficiency of a Communistic society. These comments have been abstracted from an address to the Synthetic Organic Chemical Manufacturers Association of the United States on February 10, 1959.

JOHN R DUNNING
Dean, School of Engineering
Columbia University

■ As a nation we seem to be making a series of decisions, **all of which tend toward our passive acceptance of second-rank status in the world.**

After a year of the most authoritative reassurances that, appearances to the contrary, we were abreast of the Russians in missile development–or even ahead of the Russians in missile development–it must have been a mild surprise to the American people to hear the other day that we could not even *try* to compete with the Russians in missile development.

To provide for the future–to assure that there will be a future–we must have a vigorous educational program *now*. Our progress in this area is limited by our success in solving two problems. One is the problem of institutional support, the other is the problem of attracting students into those educational programs in which they are needed. This latter problem we have not solved, and we have failed chiefly on semantic grounds. **The sciences in general, and engineering in particular, do not appeal strongly enough to the superior segment of our youth.**

Luring those young minds

This lack of appeal is based on our failure to think of academic incentives in modern terms. In the Soviet Union a full professor earns 20 to 30 times as much as a common laborer; a schoolteacher makes more than three times as much as a common laborer. In the United States, where peoples' capitalism has leveled us upwards, a full professor probably makes about three times as much as a common laborer and a schoolteacher makes one and a half times as much–not much more than a truck driver.

It is useless to think that where the slope of the curve is so small, economic incentives alone will spur a young child to the kind of academic hard work required for preparation in the sciences. You cannot say to him, as our Soviet competitors say to their children in effect, "You peasant, you–excuse me, you collective farmer, you–if you want to come out of that hovel and live like a civilized human being, do your school work. Learn calculus. Be an engineer." Our children are not living in hovels. The idea of hard school work as the way to rise in the world has no hold on the imagination of a child in a society where rising in the world is presumed to be one's natural right.

I am convinced that **the one appeal that still works** with the bright, sophisticated youngster to whom everything is easy and who has been brought up in a soft, unresisting environment, that **here is something that is not easy, not soft, . . . that does resist, and that is challenging.** In short, the best appeal is to what Milton called the last infirmity of noble mind: pride.

Engineer? Grease Monkey?

We in engineering and engineering education have only ourselves to blame for this failure to make our profession attractive to the most gifted young minds of our country. True, there is a deep antitechnical bias to much of the early experience children undergo in school. Nevertheless, even among those who survive this bias, **it is undeniable that the image of the engineer has suffered considerably in recent years. It has suffered even among engineers.**

No wonder, then, that intellectually ambitious boys and girls in high school so often associate the term engineering with crude grease-monkey work or at best with routine cookbook-and-drawing-board activity.

Our Soviet competitors do not have these problems of student recruitment. In the first place, they can assign their talent to whatever studies best suit national policy. In the second place, the simple economic incentives are very strong. **In the third place, it is a public honor to be selected for engineering study, and to be an engineer.**

The more specialized Russian approach offers great temptations. It is cheaper. It is more efficient in the short run. It is far less worrisome. But no one, I think, will succumb to those temptations. **We are going to solve our problems of educational selection and guidance according to the genius of our own free institutions.**

The answer—money

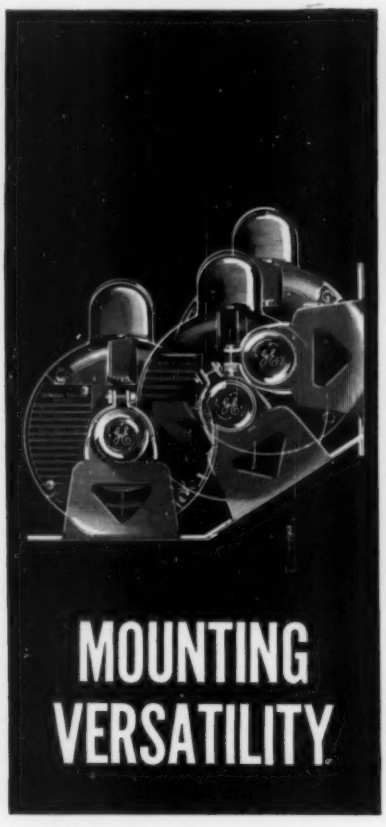
One of the most depressing features of the whole picture of American engineering education is that so little of it operates according to the capitalist principle of private sponsorship. I, for one, would be willing to risk the unresponsiveness, the confusion, the long delays in necessary reforms that are inherent in decentralized private and semipublic sponsorship–if only there were enough sponsorship.

Social change and tax laws have brought an end to the era of great private fortunes and personal philanthropies. Today we have fictitious private persons, our corporations. But will they assume their responsibilities with the same wisdom and devotion that rich families and individuals learned in the past century?

In other words, we are competing with the Russians in two areas, not one–in education achievement and in educational financing. Grave as the picture in the area of education achievement is, I have great faith that we shall ultimately prove the worth of our institutions. **What really frightens me is the area of sponsorship. If our capitalists do not believe in capitalism, can capitalism survive?** ■

DESIGN ENGINEERS...

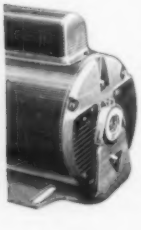
SIX WAYS



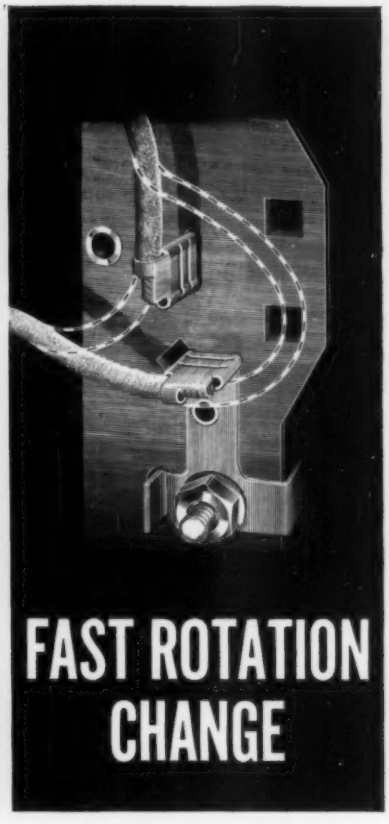
MOUNTING VERSATILITY

Cradle bases, both solid and resilient, allow rotation within base

You can rotate the Form G motor within the cradle base to take advantage of its drip-proof design, or you can position the motor with the capacitor at various angles for tight-squeeze applications. Or, you can remove the cradle base if you don't need it for your application. G-E Form G mounting versatility can mean greater design flexibility for you!



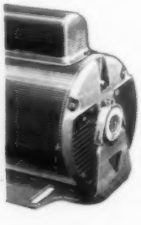
GENERAL ELECTRIC



FAST ROTATION CHANGE

Now you can reverse Form G shaft rotation in less than 10 seconds

No need to specially order motors to meet your rotation requirements. G.E.'s Form G motor features a new wiring method that lets you change rotation in seconds. Quick connectors make the change fast and positive. Just interchange the two motor leads on the terminal board. That's all. Require fast, easy rotation change? The Form G is your motor!

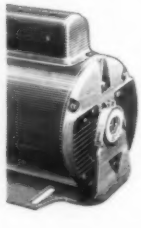


GENERAL ELECTRIC

EASY, DIRECT MOUNTING

Close end shield tolerances allow direct mounting without costly machining

General Electric standard Form G's can be mounted directly on your product without expensive machining or costly brackets. Close end shield tolerances, plus inherent shaft-to-end shield concentricity, lets you mount General Electric's Form G's with simple through bolts. This feature could be a real money saver for you. Why not investigate it today?

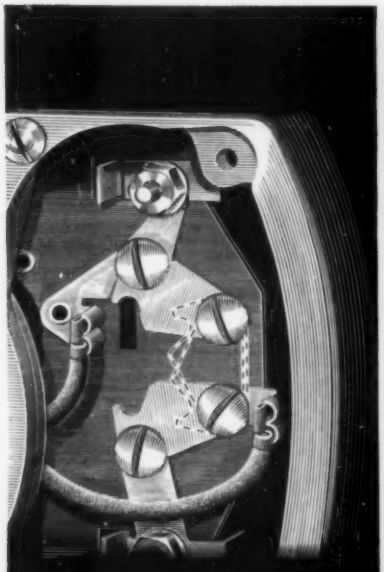


GENERAL ELECTRIC

JUST ASK YOUR GENERAL ELECTRIC SALES ENGINEER

Cut costs with General Electric Form G motors . . .

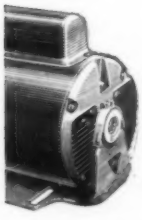
MORE VERSATILE



FAST VOLTAGE CHANGE

Unique sliding plates on terminal boards make voltage change simple

Reduce inventory, simplify ordering! You can change General Electric Form G motors from 115 v to 230 v operation (or vice versa) in 1/5th the time, without confusion and error. No special tools required! A screwdriver is all you need. Just loosen the four screws, pivot the plates to the new position and tighten the screws. That's all there is to it!

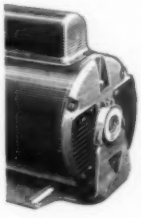


GENERAL ELECTRIC

ALL-ANGLE OPERATION

Special bearing and oil retention system permits mounting in any position

Mount it horizontally, vertically—even upside-down—the new Form G has the versatility to match the design and space requirements of your product. An advanced bearing and full oil retention system allows you to mount the Form G in *any* position and still be sure of getting faithful motor performance. In any position, Form G's do the job!



GENERAL ELECTRIC

COMPLETE LINE

Full line of Form G's means the right motor for every application

There's a standard Form G motor to meet your exact product requirements. No need for costly specials. Over 850 basic models—and thousands of variations—are available on a mass-production basis. Let your General Electric Sales Engineer show you the all-around versatility of Form G motors and how they can provide important savings for you!

702-92

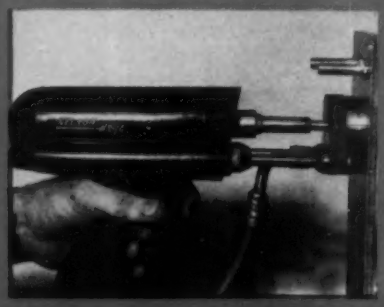
GENERAL ELECTRIC

ABOUT THE NEW FORM G "EXTRA VALUE" FEATURES

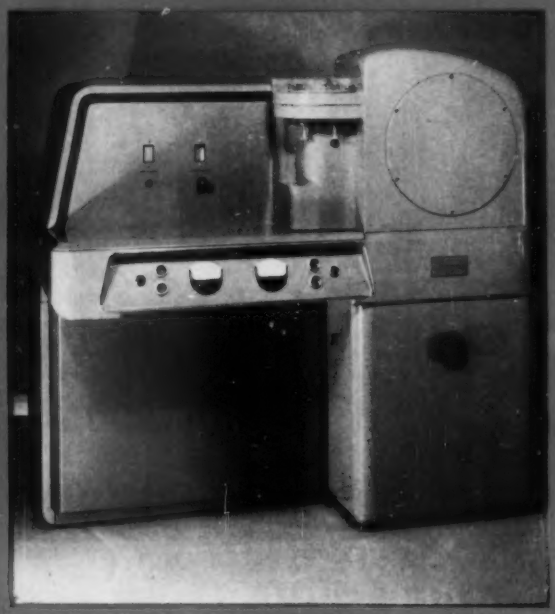
TRENDS

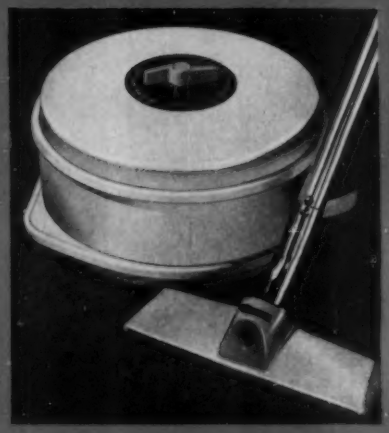
in appearance design... HERE and

X-ray spectrograph performs pushbutton analyses of solids and fluids. Compact, clinically styled housing contains radiation-shielded X-ray tube, indexing loader-changer for specimens, stabilizers, positioning goniometer, electromechanical circuits. Programming console is separate unit, not shown. Philips Electronics Inc., Mount Vernon, N. Y.

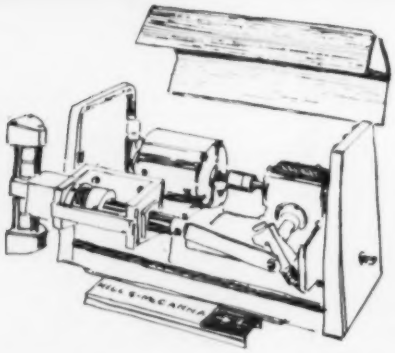


Welding aluminum studs to aluminum plate, this gun has adapter foot that surrounds weld area with argon or helium. Lines of molded plastic case and handle emphasize electrodes and other, parallel metal parts, aiding in tool line-up. Nelson Stud Welding Div., Gregory Industries Inc., Lorain, Ohio.





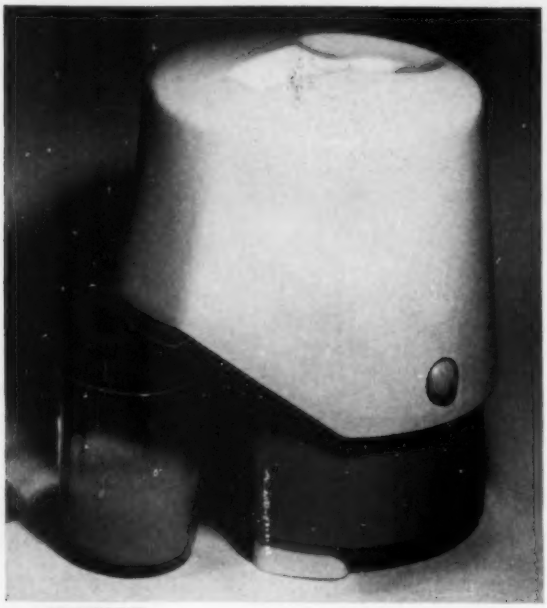
"Hat-box" vacuum cleaner is designed to be carried like one, too. Has full-width roller and swiveling rear wheel to get over deep pile carpets. Carries attachments in bottom shroud. By Dove Chapman Inc., Chicago, for Hamilton Beach Co., Div. Scovill Mfg. Co.

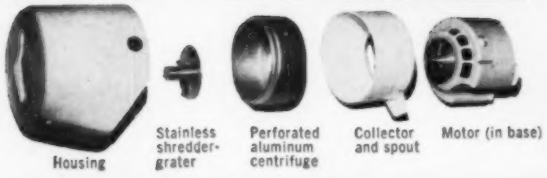


Snap-on safety shields also act as dust covers on metering and proportioning pump, made in four models handling up to 1030 gal./hr. of feed. By Palma-Knapp, River Forest, Ill., for Hills-McCanna Co.

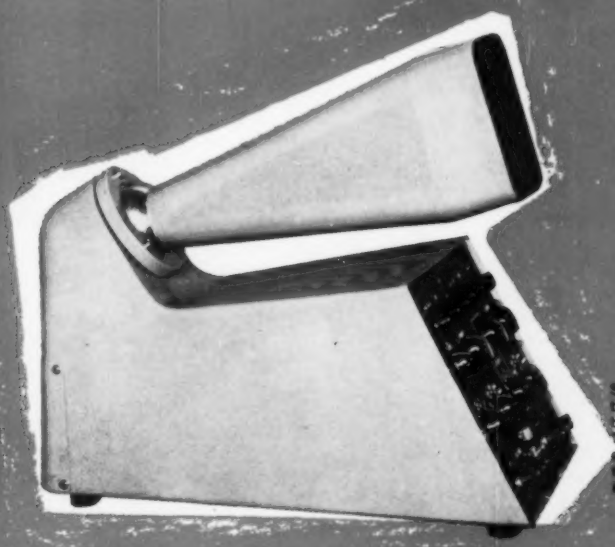
...ABROAD

Food blender (directly below) has plastic housing that keeps splash in and dust out of stainless blades, aluminum centrifuge and juice spout. Feet are incorporated in motor frame. By Novalux Gesellschaft, Cologne-Braunsfeld, Ger. Same company designed forced-air space heater (below, right). It has sheetmetal housing, whose two halves are same stamping, one reversed.





Two zinc alloy diecastings entirely enclose industrial weighing scale. Their simple lines, which make them easier to cast, flow naturally into optimum viewing angle for readings. Integral hood screens out much incident light and reflections. By W. & T. Avery Ltd., Birmingham, Eng.



Square sheetmetal cone is ball-and-socket mounted, to permit adjusting this oscilloscope's cathode ray tube both left and right, up and down—without moving base cabinet. The cabinet, with control panel, presents a heavier version of tube's cone shape, thus helping to unify instrument's two major elements and avoid top-heavy effect. By Compagnie Generale de Metrologie, SA, Annecy, France.

Greater latitude in radio cabinet design is permitted by the higher heat resistance of CYMAC® 400 polymethylstyrene plastic which will withstand continuous service at temperatures to 212°F without distortion. This property, plus its ready adaptability to complex molding and its excellent flow and color characteristics, was one of the reasons it was selected for the cabinet of the RCA Victor table radio, *The Burgess*, illustrated here.

Additional advantage of CYMAC is that it has sufficient flexibility for back cover to be secured without fasteners: a simple snap-fit reduces cost, speeds assembly, and facilitates disassembly if required. The following properties indicate CYMAC 400 is an ideal material for radio cabinets and similar housing requirements:

Resistance to heat, °F (cont.)	212
Heat distortion temperature, °F	213
Molding shrinkage, in./in.	.0046
Specific gravity	1.02
Flexural strength (1 in./min crosshead speed)	12,500
Impact strength ft/lb/in. of notch (½ x ½ in. notched bar, Izod Test)	.30
Rockwell hardness	76M
Dielectric strength, short time, ⅛ in. thick volts/mil, 1/16 in. disc	890

CYANAMID

PLASTICS NEWSFRONT

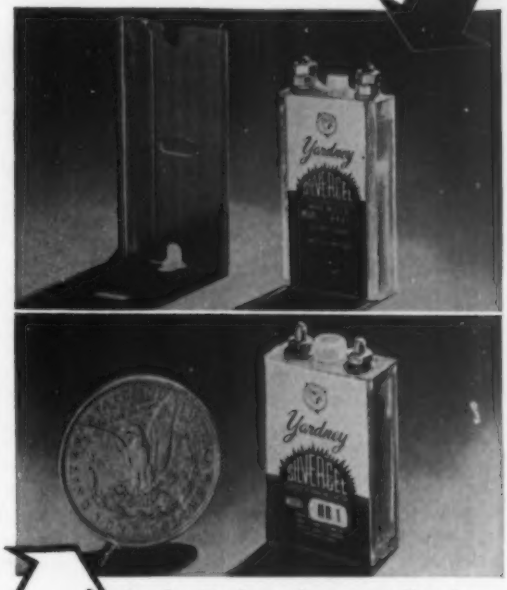
New ideas in product design and application of Cyanamid plastics.

Plastic materials and production methods behind successful products.

AMERICAN CYANAMID COMPANY
PLASTICS AND RESINS DIVISION
40A Rockefeller Plaza, New York 20, New York

In Canada: Cyanamid of Canada Limited, Montreal and Toronto
Offices in: Charlotte • Chicago • Cincinnati • Cleveland • Dallas Detroit • Los Angeles • Minneapolis • New York • Oakland Philadelphia • St. Louis • Seattle

World's smallest and lightest rechargeable battery cell, shown here with razor blade, is Yardney Electric Corporation's HRO1 Silvercel®. Designed primarily for use in instrumentation and telemetering packages for missiles and rockets, it has a 3 amp peak pulse discharge and weighs less than one-seventh ounce – thanks in great part to lightweight molded CYMAC SUPER* 201 thermoplastic case and cover.
*Trade mark



Another Yardney silver-zinc cell is shown here with a silver dollar for size comparison. This HR1 Silvercel® delivers a 45 amp peak pulse discharge yet weighs only ¾ ounce. CYMAC SUPER 201 methylstyrene-acrylonitrile copolymer was selected because of its:

- Low specific gravity (1.06)
- Exceptional combination of high tensile (11,000 psi) and high flexural (16,100 psi) strengths
- Heat resistance (distortion point 211°F)
- Complete resistance to concentrated potassium hydroxide electrolyte
- Excellent injection molding characteristics, transparence, resistance to crazing, and ease of solvent-sealing covers to cases.

New cordless electric shaver features light weight (two ounces), damage-resistant case of CYMEL® melamine plastic, designed by Raymond Loewy Associates. This smart-looking Universal shaver operates anywhere on ordinary penlight or transistor batteries. The CYMEL case is contoured to fit the hand, corrugated at the top for a natural, easy grip.

Battery and motor unit are secured by light press fit in housing compression-molded of CYMEL 1079 melamine molding compound. CYMEL resists breaking, chipping, scratching, perspiration, and corrosion from shaving lotions and battery chemicals. It provides a rich look and warm feel. Color, molded in, can't chip or wear off. Molded by Holyoke Plastics Company, Holyoke, Mass., for Landers, Frary & Clark, New Britain, Connecticut.

For more complete information on these and other Cyanamid Plastics, send for the latest copy of our catalog, *"Molding Compounds and Resins."*

New polyester resin from Cyanamid
LAMINAC® Resin 4106 for dual-spray applications

Cyanamid's new polyester resin, LAMINAC 4106, is rigid in type, with medium reactivity and low thixotropic viscosity. It is made especially for application by dual-spray methods. When so used, the resin is divided into two portions, one containing catalyst, the other promoter, both of which are stable until mixed as converging streams enter the mold. Low viscosity and slightly thixotropic characteristics promote rapid wetting of glass fibers and freedom from sagging on vertical molded surfaces. Cure is rapid, permitting production of multiple parts per day from a single mold.

TYPICAL CHARACTERISTICS-LAMINAC 4106

Viscosity*	5 poises
Specific gravity	1.1
SPI cure characteristics	
Gel time	3½ minutes
Time to peak temperature	5½ minutes
Peak exotherm temperature	400°F

*Brookfield Model RVF, spindle #1, 10 rpm 77°F

POINTS OF

THE QUESTION:

Is it Good Company Policy to Plan for a Limited Product Life?

GEORGE W WALKER
Vice-president and Director of Styling
Ford Motor Co

"No auto manufacturer deliberately limits . . .

the life of his products; therefore, the question of whether it is good policy for a company to plan for a limited product life is purely academic.

"I think it is a proven fact that the modern car is built to last far longer than its predecessors. Whatever obsolescence has been attributed to styling change is psychological. Few styling changes, if any, alter the basic function of a car, which is to transport its passengers from one point to another. The fact that a newly styled model may be offered in no way affects the ability of earlier models to perform that function.

"This newly styled car 'obsoletes' preceding models only in the minds of those who happen to own these earlier models. These people are under no compulsion to buy a newly styled offering. They generally do so for one of two reasons: either their present car has reached the point where it no longer operates at maximum efficiency, or a new model appeals to the individual to the extent that he is willing to forego the remaining operating life of his present car."

WILLIS E MORGAN
Vice-president-Marketing
Burroughs Corp

"It is wise to plan . . .

for a limited product life. Today, there is a continual cycle of research and development in the office equipment industry and products sold by our salesmen today are being obsoleted by machines now on our drawing boards. Many adding machines that we built 40, 50 or even 60 years ago are still faithfully cranking away in offices all over the country. However, by the very nature of the electronic age, requirements change almost daily and new developments come along with almost frightening speed. As a result, product life has been drastically shortened.

"Recognizing that many electronic machines are destined for a short product life, the Department of Internal Revenue is conferring with top bank officials on a rule change which will permit banks to depreciate bank automation equipment at the rate of 33⅓% a year. To protect yourself in the jungle of competition, you must continually update and obsolete your current product line. If you remain static, you will be swallowed up."

VIEW

D L McFARLAND
Manager, Industrial Design Operation
Housewares and Radio Receiver Div
General Electric Co

"No product can remain static . . .

for long periods of time in this day of technical innovation. For example, the electric iron was a drastic improvement over the charcoal 'sad iron.' The addition of a controllable thermostat was still another major step. The steam iron overnight obsoleted the dry iron, and now the spray iron has introduced a whole new cycle. In 50 years, four major innovations have taken place involving this simple, basic product. The pace of product innovation has increased in the last decade, due obviously to greater emphasis on technical research. Consequently, the average period between fundamental improvements in electric housewares is approaching five years.

"Research-minded manufacturers are continually planning better things. Perhaps the major problem in this controversial area of designing for obsolescence is recognizing true innovation and resisting the temptation to change for change's sake. Changes made to satisfy the channels of distribution instead of the customer are often wasteful of everyone's time and money. The clamor for something new when nothing really new is available, only results in glutting the market with minor variations of a thing, promotes exaggerated claims and hucksterism to distinguish between like peas in the pod. A well-conceived product need not become obsolete until a fundamental innovation renders it uncompetitive."

RAY B COX
Vice-president and General Manager
Consumer Products Div
Hoffman Electronics Corp

"Certainly . . .

but you can't do it, and survive, by using inferior craftsmanship and materials. You have to do it through constant product improvement. In consumer electronics (television, stereophonic hi-fi, radio) 'planned obsolescence' through inferiority is impossible. The customer always wants something better. By 'better' he means greater reliability, better performance and design. In order to compete you have to give it to him consistently. You have no choice.

"The only way to limit product life is to offer the customer something so much better than what he has that he will abandon the old (even though it might last him a lifetime) to get the new. Take television. Picture-tube sizes were constantly enlarged as it became technically feasible. Each enlarged tube obsoleted its predecessor, in a sense, by creating something more desirable. But each improvement of this nature also had to be accompanied by basic improvements in reliability and performance. The 21-in TV tube, for example, would not have lasted a year if it couldn't have been made to last as long, or longer, than the 17-incher.

"Limiting the life of your product by building inferiority into it, however, is the best way I know to go broke. It's as simple as that."

NOW FOR THE FIRST TIME

NEW 385

INTERNATIONAL® UDT-

Here's the all-new 385 max. hp International UDT-817—a compact, heavy-duty 4-cycle, 6-cylinder engine thoroughly proven in six years of development and testing—backed by 26 years of experience manufacturing and selling over 400,000 heavy-duty diesel engines.

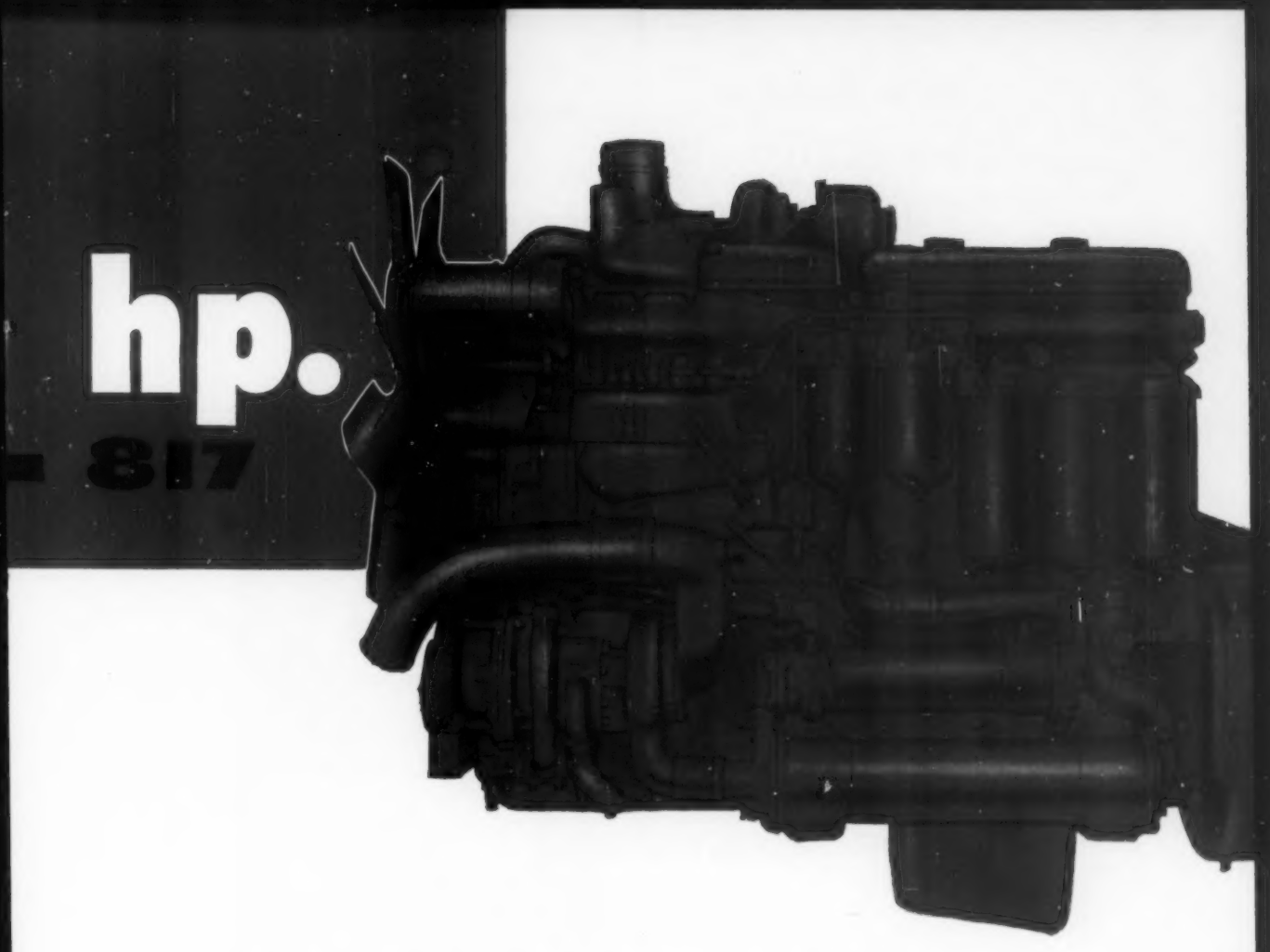
Designed for versatile application in all types of rugged hauling, excavating, construction, industrial and oil field equipment, the UDT-817 diesel answers the demand for dependable high power and lower cost of operation.

A wide variety of accessory equipment including air cleaners, flywheels for leading makes of torque converters and clutches, torque converter cooler, air control compressors, safety shut-offs, instruments and engine controls can be furnished to meet your installation requirements. Base, radiator, hood and dash, clutch and power take-off are available for complete power units.

For more specific information or application assistance, merely write or call International Harvester Co., Construction Equipment Division, Melrose Park, Illinois.

BRIEF SPECIFICATIONS

Type	4-cycle turbocharged
Bore and Stroke	5⅜ x 6"
Number of Cylinders	6
Displacement	817 cu. in.
Max. hp	385 @ 2100 rpm
Rated hp	375 @ 2100 rpm
Max. Torque	1,040 lbs. ft. @ 1400 rpm
Compression Ratio	16:1
Weight	3,540 lb.
Lbs. per max. hp	9.2
Length, fan to flywheel	61½"
Height	56½
Width	39½"
Flywheel housing SAE	No. 1



Features that add dependable, economical power to any product

- Fast direct starts with 24-volt electrical system.
- Direct injection of fuel under pressures to 20,000 psi by individual camshaft actuated multi-orifice injectors.
- Exclusive IH twin plunger metering pump directs equal and precise amounts of fuel to each injector in proper firing order according to load and speed demands.
- Turbocharger puts waste energy in exhaust gases to work for higher power output and lower fuel consumption.
- Dual intake and exhaust valves for free breathing efficiency.
- Positive valve rotators keep valve seats free of deposits.
- Aluminum alloy pistons working in replaceable wet cylinder sleeves with velocity swirl-flow water cooling on outside, jet oil cooling on inside, for long life operating temperatures.
- Fully counterbalanced Tocco-hardened crankshaft with seven big main bearings and torsional vibration damper for smooth, dependable, high power output.

International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

CIRCLE 76 READER SERVICE CARD

We make so many sizes... your "specials" could be our "standards"

We regularly produce all of the bearings shown here in a tremendous variety of bores, outside diameters, and widths.

Take just the Tyson tapered roller bearing, for example. We make nearly 1,000 sizes of the single-row, straight bore type alone! Bore sizes range from five-eighths of an inch right up to a precise fourteen inches. And these figures don't include the many other sizes available in our double- and four-row types.

Yet they are all standard SKF bearings, promptly available in large quantities at competitive prices.

So, why not get full details on the most complete line in the business? Any of our twenty-five sales offices can quote you facts and figures. Just call the one near you.

5921

Spherical, Cylindrical, Ball, and "Tyson" Tapered Roller Bearings

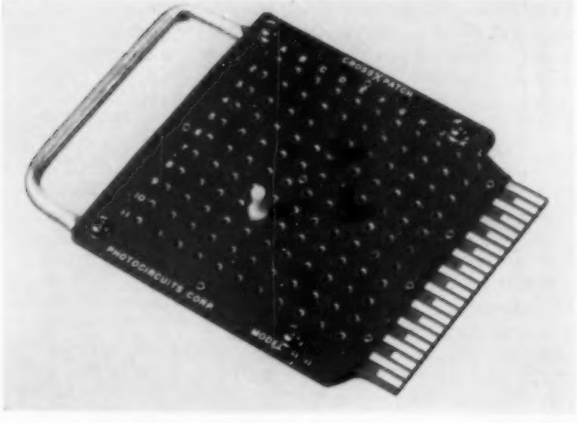
EVERY TYPE—EVERY USE

SKF®

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*REG. U. S. PAT. OFF.

SIGNIFICANT COMPONENTS MATERIALS PROCESSES



Pluggable patch-board . . .

allows any combination of eleven inputs and eleven outputs. Plastic-covered connecting posts are hollow to take lead wires from below, and they make contact through plated-through holes between as many as four different printed circuits (insulating board in center separates two circuit boards having printed circuits on both sides). For variable programming of production, testing, other automatic control equipment. Silver-plated conductors handle up to 10 amp. Can be made to match largest practical strip connectors. System costs less than other, comparable equipment. Off-the-shelf delivery is planned by manufacturer. **Photocircuits Corp, Glen Cove, NY.**

Circle 11, Reader Service Card

Lens-less multi-message display . . .

unit provides as many as 16 or 20 (depending on model) different messages on same 2¼ x 2¼ in. or 3 x 5 in. screen, without any projection system. Messages are all stored on same lenticular, photosensitive viewing screen, and are displayed when related incandescent bulb in rear of housing is lit. Screens successfully display digits, letters, charts, drawings, photos. A 16-message, 2¼ x 2¼ x 6⅜-in. desk unit is $45; 20-message, 3 x 5 x 11⅜-in. unit is $55; delivery, 30 days. **Burroughs Corp, PO Box 1226, Plainfield, NJ.**

Circle 12, Reader Service Card

High air-performance fan . . .

has air-moving efficiency of 100-cfm free delivery, about three times that of comparable fans. Made possible by inside-out squirrel-cage motor and aerodynamic fan blade. In motor, fan-blades are integral with rotor, which slips over the stator, instead of into it. Mounts on venturi block when air-moving, rather than air-stirring, is required. Axial-flow fan has over-all dimensions of 1½ x 4⅛ in. sq. Weighs 1.2 lb. Noise level is said to be 10 db lower than room air conditioned. Applicable in machines, such as tape recorders, where low noise level is important. Designed for continuous duty with life expectancy of 3 to 5 yr when operated within ambient temperatures of 40 to 110 F and within electrical rating of 105 to 120 v ac, 60 cps. Can be supplied in all versions for less than $8 each in lots of 1000 or more, which makes it applicable to variety of industrial and consumer products. **Rotron Mfg Co Inc, Woodstock, NY.**

Circle 13, Reader Service Card

Subminiature light-sensitive silicone diode . . .

of diffused N-P-N construction allows current flow when either junction is exposed to light, but effectively shuts current off in darkness. Said to be four times more sensitive than other commercially available photosensitive devices. Single-ended glass case measures 0.500 x 0.085 in. dia. A minute glass lens is located at the end opposite leads. Diode passes up to 1200 microamp when exposed to 1200 ft-c of light; in darkness, less than 0.5 microamp. Dissipation is rated 250 milliw at 77F and any biasing voltage up to 50 v, ac or dc, will operate device. **Texas Instruments Inc, PO Box 312, Dallas.**

Circle 14, Reader Service Card

vibration isolators

give more mount "mileage"

MB ISOMODE® mounts break endurance records. Despite heat, road shock and hard operating conditions in bus service, engine mounts removed for critical inspection after 132,000 miles were still good. To such durability add the superior vibration isolation afforded by a mount that controls vibratory motion in all directions.

MB concentrates on standard mounts which are actually in the special performance class. If you have a problem, avail yourself of our 20 years of experience. Send for Bulletin 616A which tells more.

MB MANUFACTURING COMPANY

A DIVISION OF TEXTRON INC.

1076 State Street

New Haven 11, Connecticut

SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .

Rotating-shaft pulse counter . . .

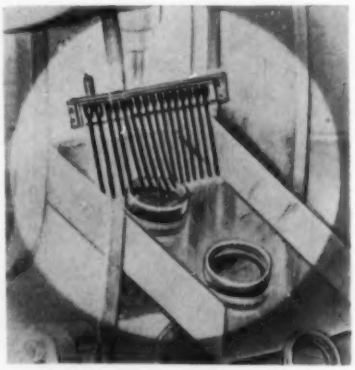
is transistor-equipped and can be applied to measuring length, rpm, position, motor slip. Can be mounted in separate power transformer to extend temperature range. Counter generates up to 1200 counts per rev and can measure length down to 1/100-in. increments with 12-in. circumference counting wheel. Operating speeds can range above 10,000 rpm with constant output at all speeds. Units can be used 100 ft or more away from control equipment without loss of reliability or accuracy. Replaceable disks can be changed in field to provide various counts per rev. Units have no gears or contacts, have negligible torque and are completely enclosed to withstand wide temperature ranges. Measures 3½ in. dia x 1¾ in. long and has ⅜ in. dia shaft. Weighs 20 oz. For industrial automation applications in which physical quantity is to be converted into shaft rotations. Standard models, $255 to $550, depending on count rate. Delivery, about 15 days. Measuring wheels, 12 to 15-in. circumference, $75. **Dynapar Corp, 5150 Church St, Skokie, Ill.**

Circle 15, Reader Service Card

Bearing aluminum . . .

that can be machined is now being stocked in a complete line. Bar is an aluminum-tin alloy with certain other metals such as copper, nickel and magnesium added to produce optimum bearing properties. Bars are said to possess good heat conductivity, embeddability, ductility, high load-carrying capacity, high resistance to corrosion, conformability to shaft and good fatigue strength. **Bunting Brass and Bronze Co, Toledo, Ohio.**

Circle 16, Reader Service Card



Electronic control unit . . .

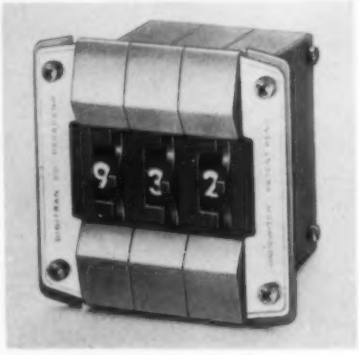
automatically disengages clutch of power machine when parts fail to eject. Detector consists of a sensitive spring wire assembly that reacts to non-ejections and shuts off power before damage can occur. Requires no setting, supervision or adjustment. Auxiliary protection is provided against misfeed, buckling, overload and end-of-material controls. **Wintriss Inc, 20 Vandam St, New York 13.**

Circle 17, Reader Service Card

Patterned steel sheet . . .

in widths to 48 in. is available as commercial or drawing quality. Can be supplied in a variety of gages, cut lengths or coils. Said to be as drawable, flat and formable as plain sheets. Any pattern that can be drawn on paper can be impressed into steel. Pattern becomes part of metal and design is limited only by severity of draw. Suitable for any decorative application. Supplementing this product is patterned rolled strip, plain or with a variety of protective and decorative coatings. **Pittsburgh Steel Co, Allenport, Penna.**

Circle 18, Reader Service Card



Modular in-line panel switch . . .

reduces panel space requirements so that 20 switches may now be mounted in space formerly required for 5 rotary switch elements. Finger-controlled switch provides for 10-position, single-pole, binary-coded decimal 1,2,4,8 and octal 0,1,2,4 coded outputs. In-line readout is said to reduce reading errors and to simplify switch setting. Switch modules may be stacked to meet requirements. Contacts are rated for 200 v, 1 amp. **Digitran Co, 45 W Union St, Pasadena, Calif.**

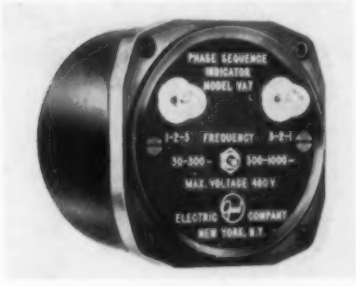
Circle 19, Reader Service Card

All-purpose contact cement . . .

combines strength and durability of solvent-type adhesives with economy of latex cements. Water-base adhesive is self-vulcanizing and becomes stronger with age. Applied by brush, paint roller, trowel or coating machine to both surfaces and allowed to dry. Surfaces are then placed together and permanent bond is formed on contact. No heat or pressure required. It is nonflammable. Though water-soluble

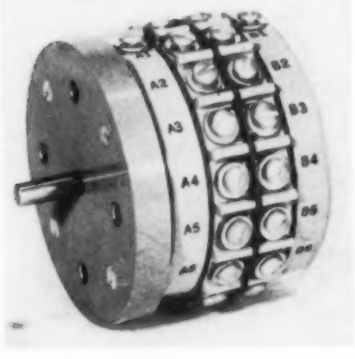
in original state, bond is water-resistant. Suitable for cementing plastics, steel to wood, plastic to leather, Masonite, rubber, fabric, plaster, concrete and aluminum. Immediate delivery from stock in pint, quart and gallon containers, 5-gal cans and 55-gal drums. Said to cost less than solvent-type cements. **Adhesive Products Corp, 1660 Boone Ave, New York 60.**

Circle 20, Reader Service Card



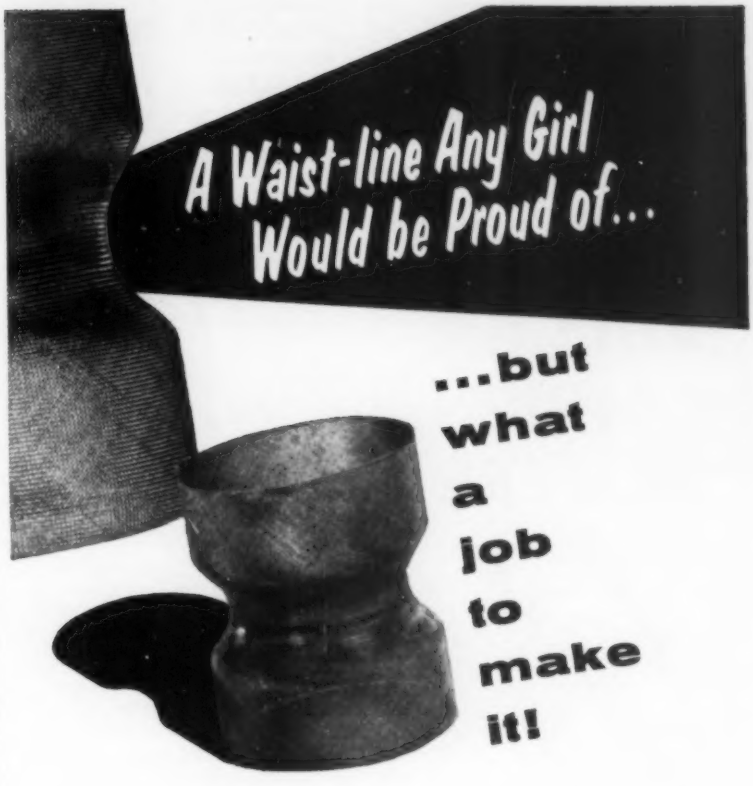
Phase sequence indicator . . . determines order in which voltage peaks occur in a three-phase power source. Panel mounting instrument is for built-in applications. Can be integrated in test stands, panel boards and special equipment whose operation is dependent upon proper phase sequence. Sequence is displayed by two pilot lamps for 1-2-3 and 3-2-1 sequence. Voltage ranges from 104 to 480 v; frequency from 30 to 1000 cps. Model will operate continuously at max rated voltage in ambient temperatures of —65 to 160 F. Priced at $59.50. **Opad Electric Co, 69 Murray St, New York 7.**

Circle 21, Reader Service Card



Miniature rotary switch . . . is said to achieve reliable performance at altitudes to 80,000 ft. Alkyd and aluminum construction is said to resist impact and effects of salt spray, humidity, sand, dust, explosion. Measuring 1 in. dia, switch has up to 10 live positions. Contacts are make and break, rated 5 amp, 115 v ac, 3 amp, 28 v dc, with a life of 10,000 double cycles at rated amperage and potential drop of less than 100 milliv. **Janco Corp, 3111 Winona Ave, Burbank, Calif.**

Circle 22, Reader Service Card



The difficulty was not in forming the waist but in forming it ***without destroying the integrity of the mesh.*** That was the problem and we solved it by developing a special rolling process.

Ours is a two-fold service: (1) we weave our own cloth in meshes ranging from 4 inch openings down to 400 mesh, most of it in any commercially available wire; and (2) we have highly experienced fabricators, especially skilled in preparing the wire cloth insert such as illustrated and then assembling it into the final piece. In other words, we are equipped to supply Newark Wire Cloth formed into special shapes and sizes and then, if desired, insert or assemble them with the other elements that make up the piece.

If you have any such project coming up, why not let us show you what we can do? And incidentally, one of the phases of our service that many times has been of help is in working with the customer's design staff on the important matter of shape and anchoring method. Sometimes a slight change in design will assure either a better piece or a lower assembly cost.

NEWARK for ACCURACY

Newark Wire Cloth COMPANY

351 VERONA AVENUE • NEWARK 4, NEW JERSEY

Choice of
Terminal Arrangements

for

VULCAN
STRIP
HEATERS

The terminal arrangements illustrated are just one indication of *Vulcan Versatility* in electric strip heaters. You also have a wide choice of standard seamless one-piece sheaths — steel for sheath temperature to 750°F, chromalloy to 1200°F; lengths 8" to 42½" (special — shorter or longer); wattage — 150 to 1500 watts (or higher); rugged non-oxidizing terminal posts. Heaters can also be formed into circles (one or two piece) in radius of 5" or more.

Vulcan Electric Strip Heaters are ideal for contact heating of dies, platens, molds, or any item with flat surfaces to which elements may be clamped; also as air heating sources for ovens, air ducts, dryers, etc.

Solve your hot problems with *Vulcan Versatility* in the application of electric heat. Send coupon for catalog and prices.

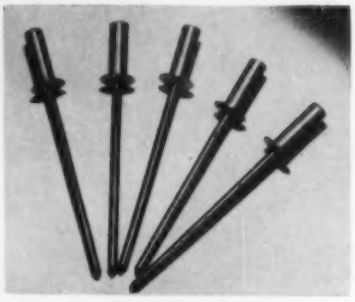
VULCAN ELECTRIC COMPANY
Danvers, Mass.

VULCAN ELECTRIC COMPANY
88 Holten Street, Danvers, Mass.

Please send me catalog and price information on Vulcan Electric Heaters.

Name & Title.....
Company.....
Street & No.....
City & State.....

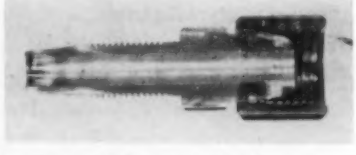
SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .



Pressure-tight blind rivet . . .

is said to be air- and water-tight at pressures to 500 psi. Also resistant to vibration and can be set with standard tools used for rivets. Set by pulling mandrel into rivet shank, spreading and setting it. Radial expansion of shank is balanced with shear strength criteria to ensure tightness. Head of mandrel is encased within rivet and sets tightly against shoulder formed during setting operation. Made with short- or long-break mandrel. When fully set, short-break mandrel breaks off directly under blind head; other breaks at point beyond work and acts as steel core to reinforce rivet. Available in aluminum in 0.125 and 0.187 in. dia. Offered immediately in small quantities. **Pop Rivet Div, United Shoe Machinery Corp, West Medway, Mass.**

Circle 23, Reader Service Card



Leakproof hose swivel . . .

is said to be patterned after aircraft, government and hydraulic standardization specs. Swivel connection is made by making two pieces and attaching them with stainless steel wire inserted into groove in swivel head. Fitting is also said to be resistant to vibration. For use on hose with $\frac{5}{16}$ to $\frac{3}{8}$ in. ID and $\frac{3}{8}$ to $\frac{3}{4}$ in. OD. Swivels are chrome-plated nickel. **Hofmann Engineering Co, 4022 W 55th St, Chicago 32.**

Circle 24, Reader Service Card

Trimming potentiometer . . .

withstands severe vibration and shock. Resistance element is embedded in an alkyd resin, which also eliminates introduction of strain coefficient during temperature cycling. Max temperature coefficient of 25 parts per million per degree C. Can also be supplied for transistor circuitry with high positive temperature coefficient. Humidity and moisture are shut out by O-ring on one end of solid sealed casing. O-ring also maintains constant turning torque. Exceeds all applicable military specifications. Available in cylindrical and rectangular case styles, ranges run from 200 to 100,000 ohm with zero end resistance and standard tolerances of 5%. 16 cylindrical units can mount in 1 sq in. **Ultronix Inc, 111 E 20th Ave, San Mateo, Calif.**

Circle 25, Reader Service Card

Alloy gold plating solution . . .

is said to produce a deposit equivalent to 18 k gold. Offers a hardness range of 300 to 450 Vhn and color superior to that obtained from conventional bright gold plating solutions. Properties are also said to be superior to those obtained by cladding and rolling and other techniques normally used. Has been used successfully on electronic components where surface pickup and wear is critical. **Bart Mfg Corp, 227 Main St, Belleville, NJ.**

Circle 26, Reader Service Card

Miniature motor-driven fan . . .

applicable as direct cooling device or in conjunction with a heat exchanger. With impeller less than 2 in. dia, unit provides a flow of 46 cm under 2½ in. water pressure and 37 w input, or 75 cfm free-flow delivery in 400 cps three-phase version. Also available with single-phase, 400-cps motor or in single-phase and three-phase high-slip motor versions for improved operational characteristics at high altitude. **Garrett Corp, 9851 Sepulveda Blvd, Los Angeles 45.**

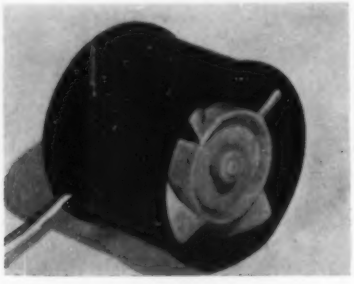
Circle 27, Reader Service Card

Silicon photovoltaic cells . . .

convert radiant energy from sun or from incandescent lamps into electrical energy. Response time is a few microsec. Operate without deterioration. Max area for a single cell is 2 sq in. and they can be supplied in many shapes and sizes. Can be wired in series, in parallel or in series parallel combinations to obtain higher

output voltages and currents. Applicable to powering of unattended and remote electronic equipment, cells also detect and measure light and shorter wave-length infrared radiation in devices such as temperature controls and photoelectric eyes. A miniature multiple cell is produced for punched tape readers. **Ferranti Electric Inc, Electronics Div, 95 Madison Ave, Hempstead, NY.**

Circle 28, Reader Service Card



Fan handles large volume . . . and high back pressure. Axial blower delivers up to 169 cfm and 100 cfm against a static pressure 3½ in. water. Designed to meet appropriate military specifications. Operates at 115 v or 200 v ac, 400 cps, three-phase. Housing and propellor are cast aluminum and entire unit is protected against severe environments. Motor is cooled by airstream. Power input at peak air volume is 120 w. Dimensions are 2⅜ x 2.812 in. dia with 3-in. servo ring attached. Weight is 14 oz. **Globe Industries Inc, 1784 Stanley Ave, Dayton 4, Ohio.**

Circle 29, Reader Service Card

Expanded-scale voltmeters . . . for ac and dc, said to achieve 0.3% accuracy, are now available with up to three separate ranges in a single meter. Each range can be read accurately to a fraction of a volt. Ac meters, which read true rms regardless of input waveform, consist of panel-mounting meter with custom dial face and small, separate transformer-can containing matched expansion network and gain-resistor circuitry. Available with any centerscale value between 5 and 230 v. Min voltage range that can be expanded across full meter scale is 5% to each side of centerscale; max range is 17% to each side. Dc multirange models are self-contained panel-mounting meters. Available with any centerscale value between 5 and 300 v. Min voltage range is 5% of centerscale value to each side; max range, 20% to each side. Offered in 2½, 3½ and 4½ in. dia round models in commercial or ruggedized and sealed versions; 2½ and 3½ in. sq and 4 x 6 in. rectangular commercial versions. **Helipot Div, Beckman Instruments Inc, 2500 Fullerton Rd, Fullerton, Calif.**

Circle 30, Reader Service Card

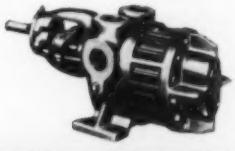
FOR YOUR PRODUCT OR YOUR PLANT

There's a Roper to Fit Your Needs

Series T .3 to 55 GPM
Choice of 192 Models

Pump and motor units . . . pump serves as end bell of motor. Require minimum space . . . easily installed . . . no coupling required . . . mount in any position. Each unit approximately same size as NEMA motor of HP required for driving. Open drip proof or totally enclosed motors; single or three phase as required.

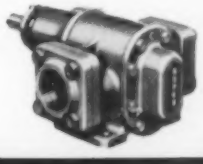
ROPER
ROTARY PUMPS



Series F 1 to 300 GPM
Pressures to 300 PSI

Feature helical steel pumping gears, hardened steel shafts, bronze flange-type bearings. 4-port design with 8 optional piping arrangements (4 for CW and 4 for CCW rotation) solves installation problems. With or without built-in relief valve in either mechanical seal or packed box construction.

ROPER
ROTARY PUMPS



Series K ¾ to 50 GPM
Pressures to 150 PSI

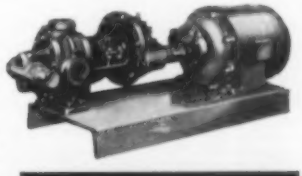
Extremely compact in all sizes. Helical pumping gears are hardened steel, with steel shafts and bronze bearings. Sizes 10 through 50 GPM have patented venturi suction and discharge principle for smooth flow and quiet operation. With or without built-in relief valve; packed box or mechanical seal.

ROPER
ROTARY PUMPS

Series H 5 to 75 GPM
Pressures to 1000 PSI

Designed to operate at direct motor speeds. Used for all types of hydraulic mechanisms where high pressures are required. Hardened steel spur gears for maximum efficiency, and heavy duty roller bearings and bronze wear plates for long life service. Mechanical seal or packed box.

ROPER
ROTARY PUMPS



Series 3600 40 to 300 GPM
Pressures to 100 PSI

Handle thick or thin liquids at slow speeds. Operate in either direction. Hardened iron pumping gears, hardened steel shafts, heavy duty bronze sleeve bearings. Mechanical seal or packed box. Series includes tank truck pumps as well as single motor driven units with gear reduction.

ROPER
ROTARY PUMPS

See Our Catalog in Sweets'
Send for "How to Solve Pumping Problems"

Roper Hydraulics, Inc.
393 Blackhawk Park Avenue
Rockford, Illinois
Manufacturers of Standard, Special and Custom Pumps for All Industries

MISSILES . . . THERMAL SHOCK . . . AND SILICONES

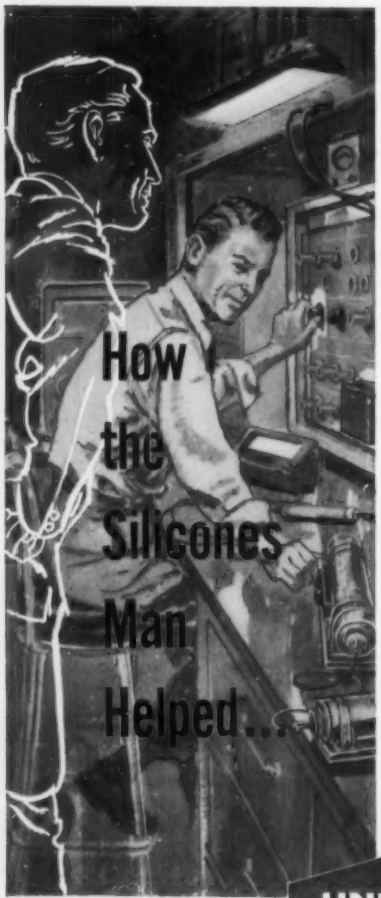
Missiles blasting off launching pads . . . hurtling through space . . . undergo extreme thermal shock caused by rapid changes from intense heat to frigid cold. Interior framework and "skin" are also subjected to severe stress and vibration. Here, helping glass-reinforced plastic components of missiles to stand up under such rugged conditions, are silicones, specially compounded for the purpose.

While specific data on missile construction has not been released, it's no secret that many interior and exterior parts of missiles and rockets get needed strength and rigidity from glass and plastic *chemically* bonded with silane finishes. This unmatched bonding power makes a solid, cohesive mass of glass and plastic, eliminating the problems caused by water or high humidity on both electrical and mechanical properties.

In aircraft radomes and stationary installations, too, silicones give strength to glass-and-plastic covers . . . for antennas, guidance and aiming units, weather observation equipment. Such military applications are comparable to more familiar commercial uses . . . in boat hulls, automobile bodies, household appliances, and building materials.

MORE CELLS IN REFRIGERATOR INSULATION...

Smaller, more numerous closed cells in urethane foam give better insulating properties — and please refrigerator makers. Foam processors, using ordinary surfactants, can expect only 25 to 50% closed cells—not enough to insulate refrigerators and freezers effectively. Recently, foam processors have found that an organo-silicone copolymer added to the urethane formula gives more closed cells than conventional foaming agents. At the same time, cells are smaller and more uniformly distributed. Thus, thanks to the use of a silicone copolymer, new refrigerators can be smaller, yet hold just as much.



. . . AND BETTER SEALS FOR FURNACE DOORS

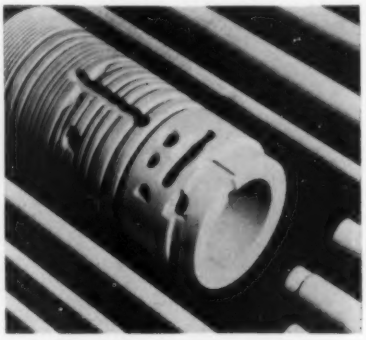
Here's an example from the hot side of the scale: A metals refiner was losing efficiency and valuable gases from his big furnaces—the result of heat losses around the mud-sealed furnace doors. The Silicones Man suggested silicone rubber gaskets in place of the traditional mud. Now, heat losses from this source have been eliminated... and the refiner collects enough CO_2 to sell to nearby industries!

The Silicones Man is accustomed to helping solve problems like these . . . and he may be able to help you, too. For background information on these and other applications, write Dept. CP-0901, Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

UNION CARBIDE TRADE-MARK SILICONES

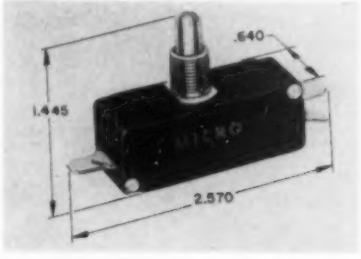
The term "Union Carbide" is a registered trade-mark of Union Carbide Corporation.

SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .



Laminated paper tubing . . . of free-machining, rolled type meet military specifications Mil-P-79B or Federal specifications L-L-31, Type 1. Tubes can be fabricated without delaminating or chipping. They have a uniform appearance and are light in color. Available in up to 12 in. ID, with wall thicknesses up to 2 in. and lengths up to 48 in. **J C Richardson, The Richardson Co, 2700 Lake St, Melrose Park, Ill.**

Circle 31, Reader Service Card



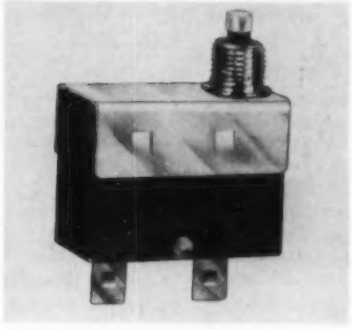
High-overtravel switch . . . has special plunger mechanism that provides min of 0.2-in. overtravel without curtailing switch life. Median mechanical life of switch is said to be over 2 million operations at full overtravel. Snap-on terminals speed wiring. Switch can be mounted from side or through a panel. Contact arrangement is SPDT. May be wired normally open or closed and is electrically rated for 15 amp, 125 or 250 v ac. Nickel-plated plunger and threaded bushing will complement design of any domestic appliance. **Micro Switch, Freeport, Ill.**

Circle 32, Reader Service Card

Miniature rectifiers . . . of selenium are offered in a wide range of voltages and currents for use in half-wave, full-wave, single or three-phase rectifier circuits. Dimensions depend upon voltage and current requirements. Rectifiers are

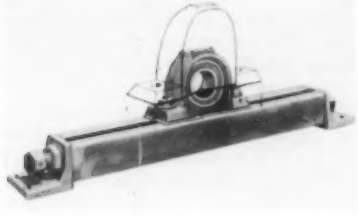
completely potted and said to be low in cost. Designed to meet applications in which space is limited. Ready for immediate delivery. **General Instrument Corp, Radio Receptor Div, 240 Wythe Ave, Brooklyn, NY.**

Circle 33, Reader Service Card



Indicating circuit-breaker . . . available with ratings for use at 5 to 25 amp, is primarily for remote, overcurrent protection of 110-v ac motors through ½ hp. To locate tripped circuit, this model has indicating band. Double-break contacts help maintain calibration by reducing contact erosion. Weighs 1 oz. Thermal-type unit has vibration resistance of 10 to 55 cps, 0.06-in. total excursion and shock resistance of 50 g. **Metals & Controls Corp, Spencer Div, Attleboro, Mass.**

Circle 34, Reader Service Card



Take-up frame . . . permits use of any pillow block now on market. Basic frame size accommodates ball, roller or babbited types. Can be top- or side-mounted by loosening locknut and swinging flange connection either way. Range of sizes and travel lengths from 2 to 36 in. are available from stock. These will accommodate pillow blocks from ½ to 2 7/16 in. **Lovejoy Flexible Coupling Co, 4856 W Lake St, Chicago 44.**

Circle 35, Reader Service Card

Enclosed slow-speed motors . . . are suitable for powering small electrical appliances, motion displays and electrical devices where resistance to heat and splashing contaminants is important. Fhp motor is said to be low in cost. **Brevel Products Corp, 601 W 26th St, New York 1.**

Circle 36, Reader Service Card

Chace THERMOSTATIC BIMETAL

ACTUATES ANOTHER PRECISION PRODUCT . . .

THE **PACE** "SNAP ACTION" THERMOSTAT

A Product of Pace, Inc.
Mansfield, Ohio

The breaker shown above (only 2" length, excluding terminals) is the newest addition to the high quality Pace line of bimetal thermostats. The "Snap Action" — type JS — is engineered for heavy duty and ruggedly built for long life under the toughest conditions. It is available in both adjustable and non-adjustable models for applications such as "positive control for room and automotive air conditioning, wall and base board heating and ventilating, fans, vending machines" . . . and other motor driven appliances. The rating is 15 amps, 230 volts, range 0° to 300°. The actuating element of this reliable control is Chace Thermostatic Bimetal.

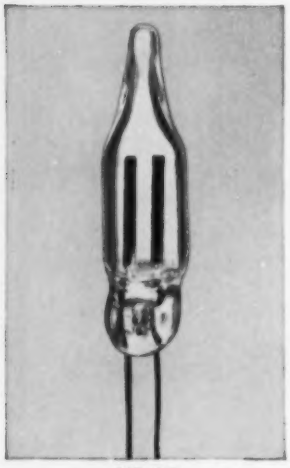
Pace pays Chace the ultimate compliment when they say "Pace thermostats are not code dated. Your warranty to your customer is our warranty against defective materials and workmanship." Only a manufacturer with complete confidence in the absolute uniformity of the bimetal element or strip he installs in his protective device would dare make such an unqualified guarantee. But Pace *knows* Chace, its uniformity of alloys, uniformity of processing the alloys into over 30 bimetals, uniformity of bimetal production methods which assure precision tolerances in rolling, slitting, cutting to length or blanking to customers' specifications. Our better than a third of a century in the business has proven that such uniformities are our surest means of gaining and keeping good will.

If you are designing a device for temperature indication or actuation or for protection of valuable equipment, send for our booklet, "Successful Applications of Chace Thermostatic Bimetal." You'll find the engineering and design data extremely useful.

IT BENDS WITH THE HEAT

W. M. CHACE CO.
Thermostatic Bimetal
1607 BEARD AVE., DETROIT 9, MICH.

New G-E Glow Lamp
permits less critical biasing ...provides wider margin in circuit designs



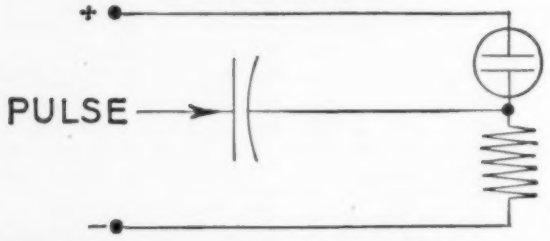
NE-97

This General Electric NE-97 (and its first cousin, the NE-96) look exactly like the familiar NE-2 . . . but each of these General Electric Glow Lamps has a wider differential between starting and operating voltage. This feature provides a margin of safety against false starting caused by transients in the circuit, since at least a 30-volt pulse is needed to put the lamp in operation.

DIRECT CURRENT CHARACTERISTICS	NE-97	NE-96
Starting Volts	125 ± 15	135 ± 15
Operating Volts	70 ± 10	70 ± 10
Design Current	0.5 m.a.	0.5 m.a.

Life—Change in Starting and Operating Volts at 0.5 m.a.—5-Volts in 1,500 hrs.

MEMORY CIRCUIT

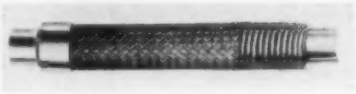


APPLICATIONS—Because of the wide spread between starting and operating voltage, the General Electric NE-96 and NE-97 are well suited for use in switching circuits and counters, where the lamp may function both as the transfer element and an indicator of state or sequence. For full information on G-E Glow Lamps, write for "G-E Glow Lamps As Circuit Control Components". General Electric Co., Miniature Lamp Dept., Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .



Vibration-resistant connectors . . .

include tube or pipe ends, for brazing or welding into tubing or pipelines, as well as threaded and/or flanged ends. Units eliminate vibration and dampen noise in a broad range of pipeline applications and pump systems. Rated up to 15,000-psi burst pressure and for temperatures to 1500 F. Scale formation is minimized while handling exhaust, superheated steam, gas or oils at extreme temperatures. Made in stainless steel in all standard pipe sizes from ¼ through 12 in. Immediate deliveries on standard units. **Allied Metal Hose Co, 3796 9th St, Long Island City 1, NY.**

Circle 37, Reader Service Card

Volumetric flowmeter . . .

provides output signal proportional to flow. Consists of electronic readout and one or several zero-leakage, low-differential, operating-pressure cylinders. Signal is fed to readout circuit, which indicates volumetric flow on any one of several selectable scales. Flow-measurement resolution is said to be better than 1 part in 3000 for a single cylinder unit. Calibration and operation are claimed to be unaffected by fluid viscosity or temperature over wide ranges. **Industrial Measurements Corp, 250 N Thomas St, Pomona, Calif.**

Circle 38, Reader Service Card

Circuit design kits . . .

include a selection of varistors or thermistors from which most applications may be solved or from which basic specifications may be derived. Kit KR75 contains eight thermistor rods ranging from 0.05 to 0.112 in. dia with resistance values of 3000 to 100,000 ohm. KP50 is a glass probe thermistor kit with thermistors in decade steps from 100 ohm to 10 megohm. KD25 thermistors range from 0.1 to 1 in. dia with resistance values of 10 to 10,000 ohm. Contains 13 thermistors. KV100 has eight varistors with varied electrical characteristics and shapes to provide an over-all voltage-current range of standard varistors. All kits with data, technical characteristics, resistance vs temperature curves. **Victory Engineering Corp, 546 Springfield Rd, Union, NJ.**

Circle 39, Reader Service Card

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NEW LITERATURE

A Guide to Engineering Education

FRANK W ELLER. Science Manpower Project Monograph, Bureau of Publications. Teachers College, Columbia University, New York. 5½ x 8¼, paper-backed, 45 pp. $1.

The Science Manpower Project was financed by a group of corporations and foundations in an attempt to improve science education in our schools. This monograph, first in the series, provides guidance information that the highschool teacher might offer students interested in engineering careers.

For the most part the information is elementary: recommended highschool courses, descriptions of the branches of engineering, and a list of accredited engineering colleges separated by region and courses offered. However, a chapter on criteria for identifying potential engineers should be welcomed by all parents as well as teachers. It is a condensation of the literature as well as a listing of specific characteristics shared by most successful engineering school candidates. Those "most likely to succeed" in engineering are likely to have:

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This personality pattern is most likely to succeed as an engineer. Is it yours? Your son? –RMK

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STEEL FORGINGS–Brochure, 40 pp. Covers facilities, techniques, quality control, product engineering and estimating, production equipment and examples of typical forgings. Cameron Iron Work Inc, PO Box 1212, Houston.

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The benefits that follow publication of an honest, carefully thought-out engineering article may surprise you. Hundreds of engineers start their letters to us and each other with references to an article "in last week's PRODUCT ENGINEERING". They have been started in a line of reasoning or shown a new design tool or given a set of reference data for their permanent files. This is a direct benefit, and probably the most obvious one.

But look at what publication can do for you and your company, too. Personal prestige is hard to measure, but no consultant got started on his own without establishing his reputation with published articles in his field (see *PE*—Feb 23, p 30). No director of research got promoted to his job without the recognition of *outsiders* as well as company executives.

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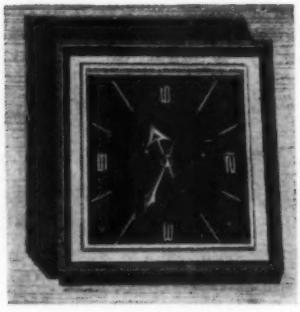

Little battery gives lots of time

What with solar clocks and radios, new fuel cells and the like, standard power sources seem almost outdated. But General Time Corp has come up with two new clocks that seem worth mention: One is a wall model (see photo) designed to operate for 12 to 15 months on a single, standard flashlight battery—no winding required and no cord. It's called the "Portrait," and is $45. Another design, the Vista, $65. These are by GTC's Seth Thomas Div.

From GTC's Westclox Div comes another new model, a wrist alarm. It has the most conventional power source of all—hand winding—but features low cost: $19.95.

Puzzle—find the kitchen

The "furniture look" is gaining ground in home appliances. Youngstown already has its wood-finish cabinets (*PE*—June 16 '58, p 5). Now, Hotpoint plans soon to introduce (at a retail price of about $800) a Swedish Modern range that looks much like a TV set on a 54-in. wood table (the "TV set" is the oven; and the burners are in the wood-finished table top). The walnut finish is a silicone enamel which, Hotpoint says, will resist 600 F.

Also given a wood finish is an indoor barbecue set, 54 in. long, containing "master pushbutton control," four surface units, and a recessed barbeque pit which can be raised or lowered automatically. This one, to be marketed next year "if demand develops," will be priced at close to $1000.

Hotpoint, incidentally, is predicting a 13-million-appliance year and expects about 1¼ million electric ranges to be sold.

Electric-range makers aren't sitting around waiting for that demand to develop, though. They've just set up a National Communications Center under NEMA auspices to promote the advantages of electrical cooking and supply information. This "Nancy Nema" center will be at 155 E 44th St, New York 1.

Plastics on the hunt

First, it was plastic practice bullets. Then came a gun specifically designed to use live plastic ammunition—shells made of plastic, triangular in shape. Now, meet the nylon auto-loader. It's Remington Arms' newest model, a .22 caliber rifle known, appropriately enough, as the "Nylon 66." Its advantages, in addition to light weight and corrosion resistance: "The gun's action is virtually free of friction, and no lubrication is needed, aside from protective oiling of steel parts." All moving parts bear against the nylon; and, says Remington, "each shot can be directed with unvarying accuracy and no change of impact." Price $49.95.

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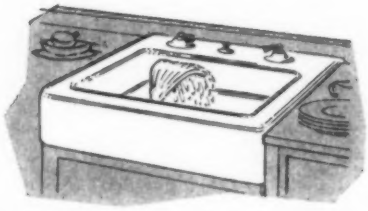
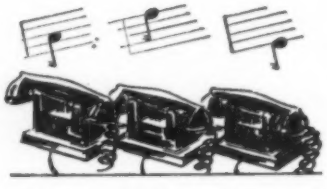
Why Don't They

RESEARCH and DEVELOP . . .

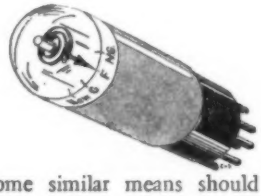


. . . a smarter faucet for the kitchen sink—one that won't break dishes. Plastics may not serve since heat as well as scuff resistance is essential, but rubber-coated metal might do the job or else how about designing a fountain type of spray that would come from a recessed outlet in the near side of the sink? —R W SMITH



. . . an adjustable-pitch, pleasant-sounding tone generator to replace the usual telephone bell. By varying a single (or better, a double) tone among adjacent phones the ambient noise level could be lowered and there would be no problems about which phone was ringing in a crowded office. G WENKE

. . . a simple transmitting device for commuter trains with correspondingly simple receiver (a standard radio receiver might serve if properly tuned) for the waiting commuter. The transmitted signal would be in code to indicate when an approaching train is on schedule or late, and how much. —H S RENNE



. . . an electron tube telltale of some kind to indicate when a tube filament is open-circuited. Filament glow could be focused on a fluorescent spot at the top of the tube envelope and the color might be an indication of tube condition. Some similar means should be developed to indicate tube shorts as well—to eliminate the problem of carrying maybe 25 TV set tubes to the local radioman at regular intervals. —A E NEWTON

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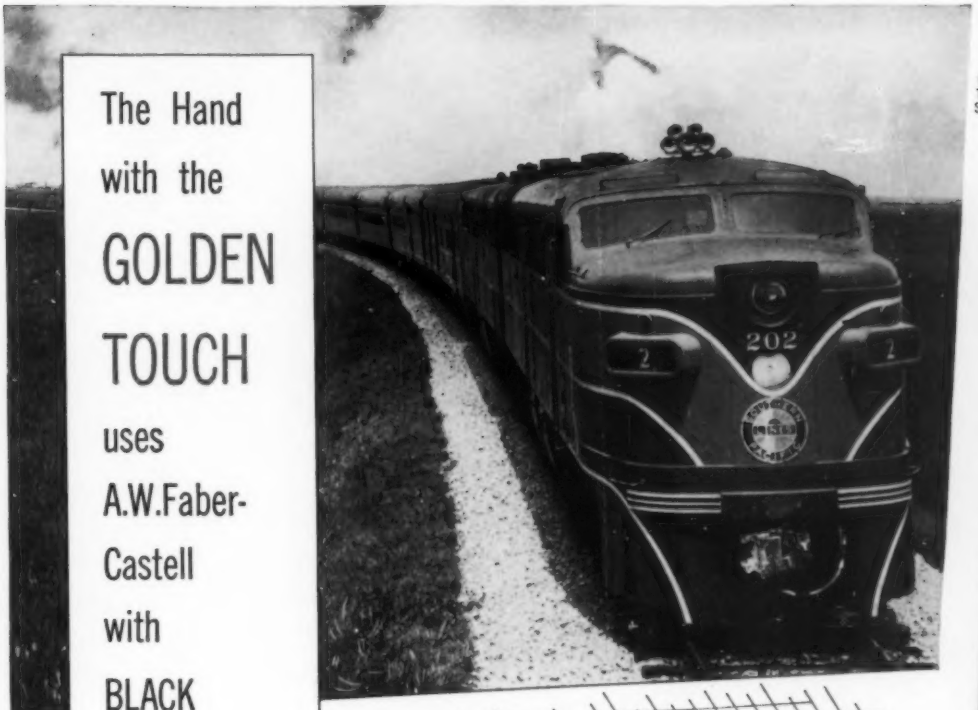

"Sunset"
Photo courtesy of
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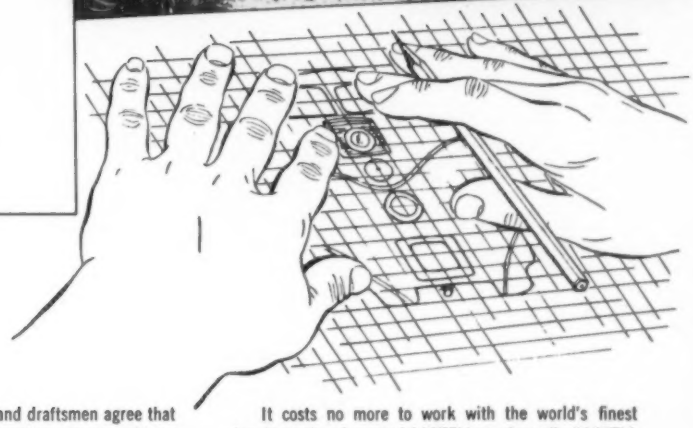

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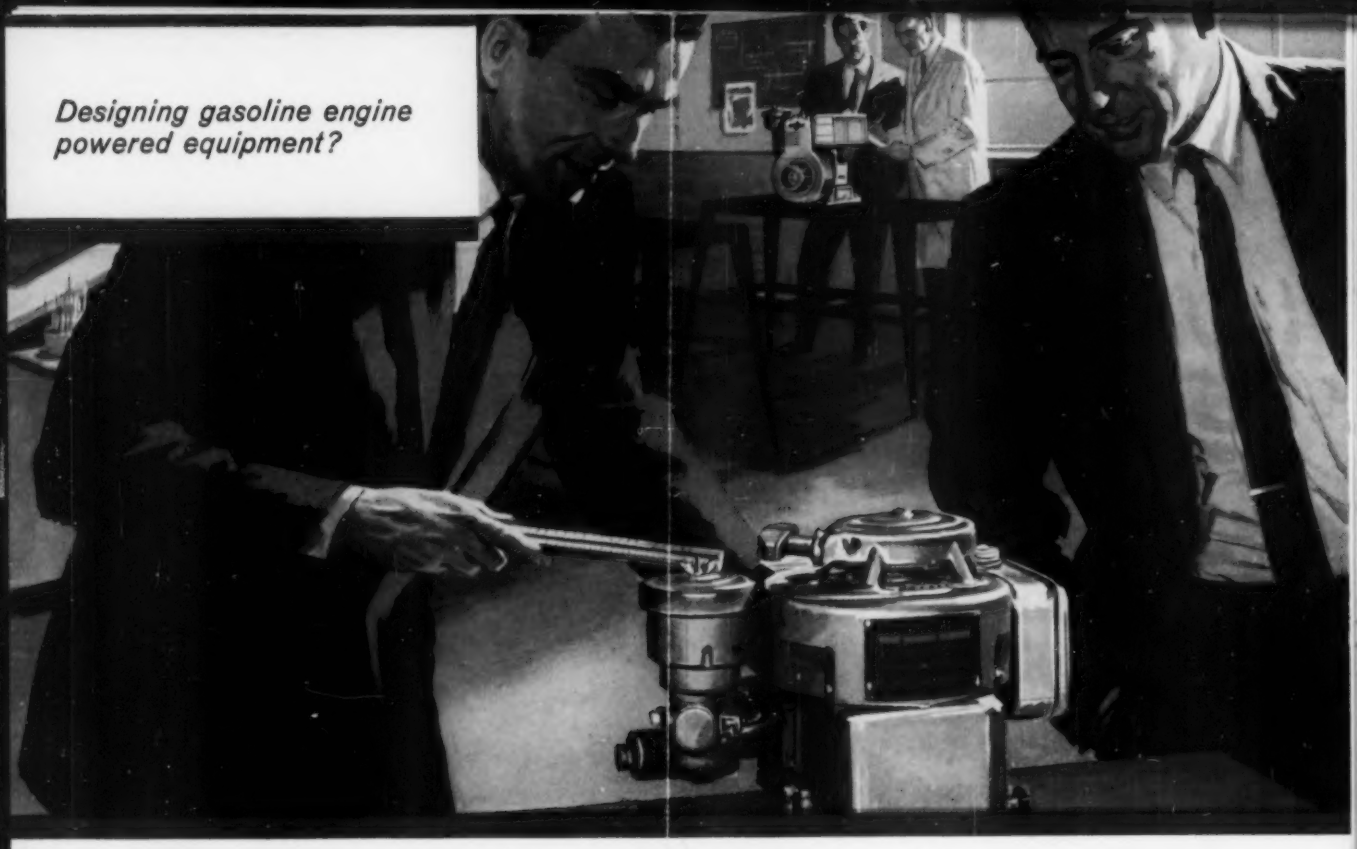

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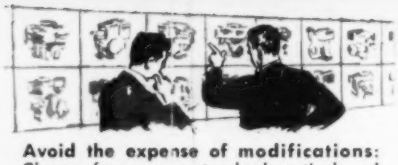

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